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The Outlook

Progress

AT a time when we have once more had a spate of aircraft accidents, of which not only the daily papers (that was to be expected) but even the B.B.C. made the most by failing to distinguish between civil and Service crashes, it is useful to look at the other side of the picture which has been created in most people's minds by the unwarranted prominence given to every flying accident, be it serious or trivial.

To get things into their true perspective, it is worth recalling that it was in 1919 that Sir John Alcock and Sir Arthur Whitten Brown made their historic flight from Newfoundland to Ireland, the first time the New World and the Old were linked by air.

The much more difficult feat of making the east-to-west crossing was not accomplished until April, 1928, when an Irishman, Col. James Fitzmaurice, and two Germans, Baron von Hünefeld and Capt. Hermann Köhl, flew a German monoplane to Greenly Island in Labrador.

Just over twenty years ago, in May, 1927, the first direct flight between the North American mainland and Europe was made when Charles Lindbergh flew his Ryan monoplane from New York to Paris.

A high price was paid for the "conquering" of the Atlantic. For every successful attempt there have been several unsuccessful, a great many resulting in the loss of life. During the years preceding the second world war, experimental flights on a much larger scale, organized by governments or, at any rate, with government backing, laid the foundations for regular passenger-carrying flights across the Atlantic. Then came the war, with its interruption of civil flying but also with an intensification of trans-Atlantic flying by Service aircraft, the losses incurred during which were relatively small in comparison with the number of flights made.

It was not until last year that proper working of the trans-Atlantic air routes really got fully established, and even then there were occurrences which prevented full effectiveness of the services—such as the grounding of the Constellations, for instance, which robbed B.O.A.C. of a good deal of operational time. During 1946 some really impressive air traffic results were achieved. No fewer than 3,670 crossings were made by the different operating companies, and the total number of passengers carried exceeded 100,000.

As was to be expected, America carried the greater proportion of this traffic. Our French contemporary *Les Ailes* points with justifiable pride to the fact that, in spite of its very severe handicaps, Air France made 173 trans-Atlantic flights and carried 5,214 passengers. Although that was a fairly low figure among the operating companies, it was highly creditable in view of all that France suffered during the war.

According to our contemporary, the American companies made between them 2,898 flights; B.O.A.C, 194; K.L.M., 189; and the Scandinavian, 113. Figures such as these, especially when contemplated against the background of the pioneer flights which laid the foundations for trans-Atlantic air transport, provide encouraging proof of the progress that has been made.

There is certainly no room for complacency, and we shall have to do very much better in the future, but at least these achievements should serve to show that flying, at any rate trans-Atlantic flying, is not as dangerous as the distorted picture served up to the general public is calculated to suggest.

Headaches Ahead

THE decision of the Australian Government to make Qantas Empire Airways an Australian State-owned concern by buying up B.O.A.C.'s share is likely to raise a number of thorny problems. Discussions have begun between Mr. Hudson Fysh, B.O.A.C. and the British Government, who will be joined by Mr. Drakeford, the Australian Air Minister, as soon as he

arrives here from the I.C.A.O. meeting in Montreal.

Among the many problems to be settled if co-operation between Qantas and B.O.A.C. is to continue are those created by the fact that the British corporation will be making increasing use of flying-boats, so that in most cases it will not be possible for the two companies to share bases, ground personnel and services of various kinds. This will increase the cost of running the services, and doubtless B.O.A.C. will feel that by being compelled to use the flying-boats against the Constellations which the Australian company intends to operate, the competition is apt to be somewhat unfair. It will, however, be interesting to see the verdict of the travelling public, a large section of which has hitherto shown a marked preference for the flying-boat, preferring its quiet and comfort and more leisurely progress to the "cannon-ball" service's time-saving speed. After all, few are in such a desperate hurry that two or three days extra spent on a voyage of 10,600 miles is likely to be a serious handicap.

Welcome Visitors

ONE of the most embarrassing characteristics of our North American cousins is their hospitality. Many a British visitor to the United States has experienced this, and most feel it to be quite impossible to reciprocate on any adequate scale in present circumstances. However, it is to be hoped that the 150 officers and men who are now paying us a good-will visit in their Superfortresses will return to their own country with the most pleasant memories of their all-too-short stay in Great Britain. Whatever our shortcomings may be in purely material things, our American friends will certainly feel the warmth of our welcome and that they are among friends. We have not forgotten, nor is the R.A.F. likely ever to forget, the reception given to our R.A.F. aircrews when they have visited the United States.

The Americans were officially received at Marham, Norfolk, last Monday by Marshal of the R.A.F. Lord Tedder, Chief of the Air Staff, and by Mr. de Freitas, Under-Secretary of State for Air. On Tuesday a civic reception was held by the Mayor of Norwich, and the rest of this week is being spent in visits to famous places and flights over various parts of the British Isles. A full account of the Americans' week in this country will be published next week.

It was a happy coincidence that the visit by the Americans should afford them an opportunity to be present in the forecourt of Buckingham Palace to-day, and some of them on the Horse Guards Parade to witness the actual ceremony of Trooping the Colour on the occasion of the King's Birthday. They will be doing even better than their famous compatriot Will Rogers, who once reported that he had been to London to see the Changing of the Guard and to Paris to see the Changing of the Government.

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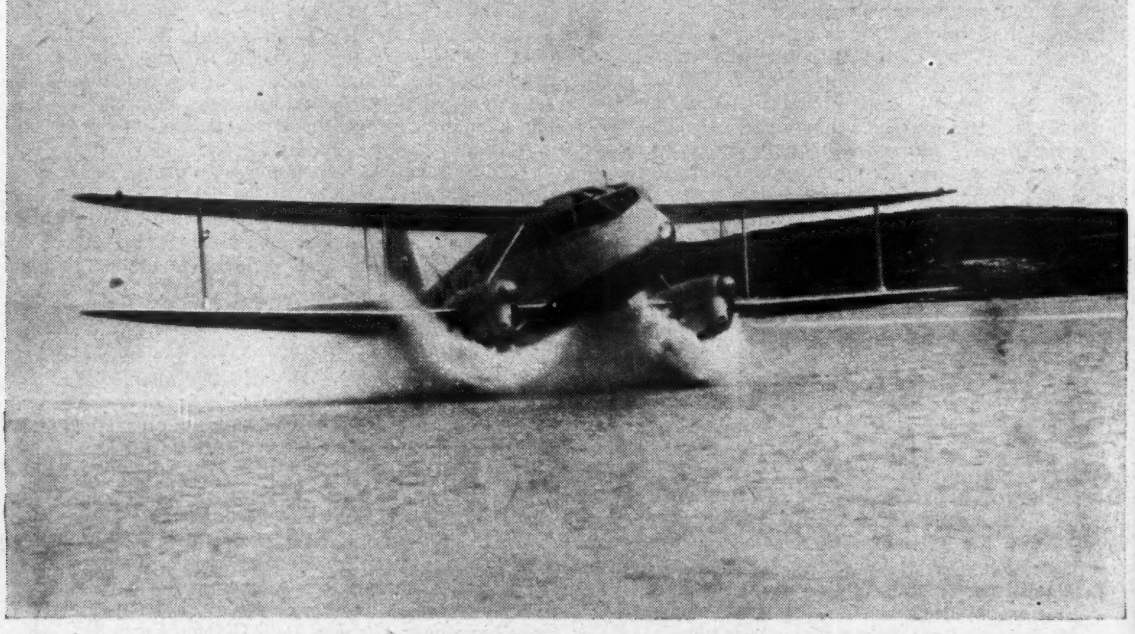
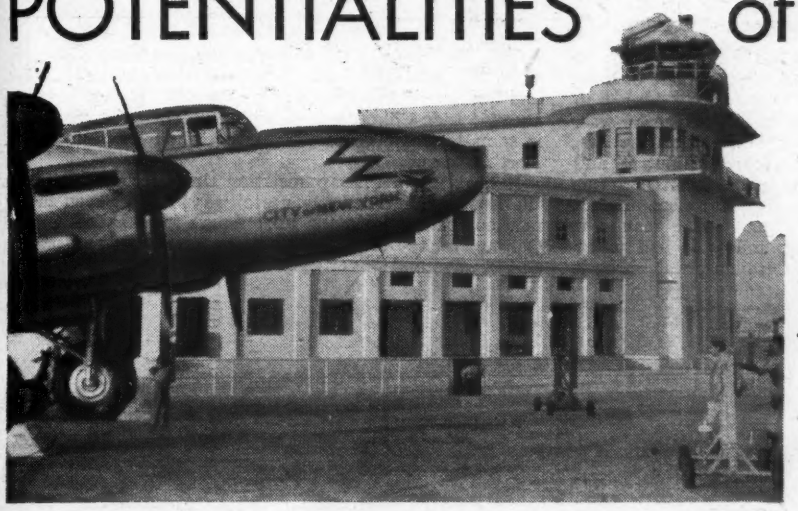


BOW WAVE: Landing on the beach at Barra, in the southernmost group of islands in the Hebrides, as the tide runs out. When asked how he knew if the tide was sufficiently low, one pilot said that if he could see the seagulls' legs, it was all right. If they could stand he could land.

POTENTIALITIES of the GREAT EAST



Silver City Airways Lancastrian at Karachi Airport—reached late afternoon on the day after leaving London Airport at lunchtime.

Air Transport Taken for Granted : New Companies Springing Up : The Navy's Need for Communications Aircraft

By B. J. HURREN

IN the fierce Battle of Peace which is now raging in nearly every Continent, the fact that in one corner of the world people are actually working hard to restore normality escapes the news columns. (For, as the cynic has remarked, there's no news value in virtue.)

In the Great East, despite the sore spot of Java where the Dutch and Indonesians represent two opposing and, it is to be feared, irreconcilable ideologies, events are moving with surprising speed to a vast revival of trade.

The Great East has come into being as an entity and consists of such immensely lucrative territories as Malaya and what is the virtually island state of Singapore; of Borneo, Sarawak and Brunei; the Celebes; the Moluccas and New Guinea. Java, richest plum of all in the Great East, is temporarily in balk; but Java's almost incredible natural wealth in every commodity which the world at large has in short supply, provides a key and a clue to what can be done in these lands of acute fertility and the abundance of the Earth.

One more point in this preamble, and I think this will take many by surprise: In Java alone there are said to be 60,000,000 people—most guesses are around two million. In the Great East as a whole, there are nearly 200,000,000, and the vast majority are concerned with the Earth's produce although important sections concern mining and oil. Of these people, who claim racial characteristics of Malays, Javanese and what may be termed "coffee-skinned" races, there is a numerical preponderance. But the Chinese are everywhere—Singapore city, whatever the British may say, is a Chinese city.

All the fabulous wealth of the East lies within the boundaries of the Great East, distinct from the Far East which has a geographical centre between China and Japan. The significance of the Great East is that potentially its development could alter the whole economic course of the East and probably the World; and that it is largely under English influence, with our Dutch friends a close second and the Americans far behind, since their sphere is the Far East; and thirdly, that the Great East is comprised of numerous islands, large and small, the products of which must be carried away elsewhere for trading if their development is to be realized. Land transport is insignificant in the trade development of the Great East; and the future of air and sea transport has yet to be determined and is now being shaped.

The Hotel des Indes, Batavia. Considered by many to be the finest hotel in the East. Indicative of pre-war Dutch splendour and lavishness.

Three Conversations

I should like to record now the gist of three conversations I had recently; one in Batavia, one in Singapore City, and one at Sembawang, the Navy's air base on Singapore Island.

The first was with a high executive of a powerful commercial group. His territory covers the Dutch East Indies and the many British possessions studded there, including the great island of New Guinea, where the Australians have direct interests at the eastern end and the Dutch at the western.

This executive wanted a personal aircraft for his staff—something between a six- and ten-seater, with luggage. (I may interpose here that almost daily similar enquiries

POTENTIALITIES OF THE GREAT EAST

come in to Britain from abroad, from Cairo eastwards.) I must add he was (a) an experienced air traveller, both as pilot and passenger; and (b) he was entirely biased in favour of British goods, not in the least because he was, as are most other Englishmen, short of American dollars.

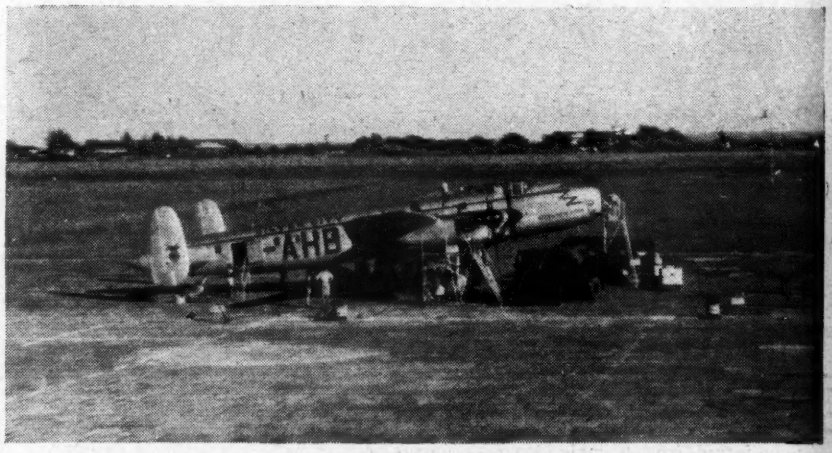
After a close examination of the market as I knew it, and I suspect he knew far better than I, the admission was reluctantly forced that no British or even European aircraft filled the category he required. It had to be metal; it had to haye a range of over 1,000 miles; it had to be reasonably fast, i.e., none of that Catalina crawl stuff; it had to be multi-engined. But the real catch came in maintenance—for although the Dove and the Marathon might well have fitted the bill, and been welcome, the engine overhaul period seemed to him too short for useful life between periods of absence. No, he couldn't afford two or three aircraft, he wanted one good one for himself.

And the answer was that the only British aircraft which suited the flying and maintenance characteristics he required seemed to be a Beaufighter, though how you turn a Beaufighter into a Beau Brummel personal plane I don't pretend to guess.

The next significant talk was with the Director of Civil Aviation, Malaya. Among other things he made a surprising statement, an eye-opener statement. Whatever the cause, he said, the indisputable fact is that the East as a whole has tacitly accepted air transport. Before the war, only a very small percentage of orientals flew or even thought of flying. Today, with their memories of flying in the war, with the cumulative effect of press reports, radio news on aviation and especially the incalculably great influence of the films, the Orient has now accepted flying as being as normal as motor cars, ships and trains. Seventy per cent of the ordinary passengers today are orientals.

This statement seems to me of the greatest significance. With 200,000,000 potential customers in the Great East, and 400,000,000 in China alone, to say nothing of Siam, Burma, Indo-China, the air traffic potential of the Orient is something far greater than the whole of Europe and North America.

Indications of this appreciation that in the near future the East will increasingly use airways can be seen in the new companies springing up. Apart from B.O.A.C. and Qantas and the important British charter companies such as Skyways and Silver City Airways (which, incidentally, has powerful Australian backing and under Air Commodore "Taffy" Powell is growing like the magic beanstalk) the traveller can see the trend of the future in the newly established Malayan Airways (backed by the Fred. Holt shipping people and officially recognized by the Malayan Government); Orient Airways; Burma Airways; and, of course, the great companies of K.L.M. and K.N.I.L.M.

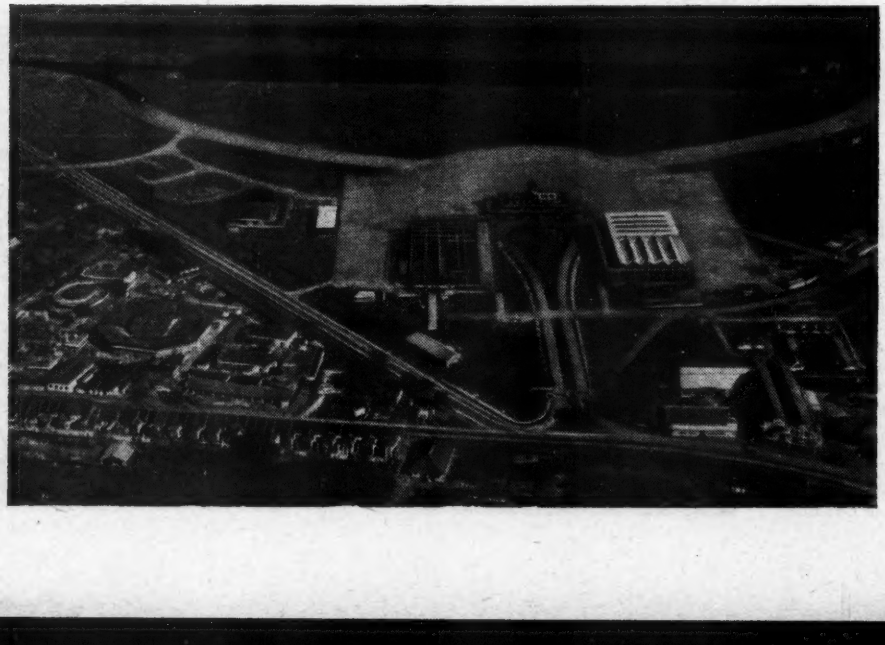


At Kallang Airport, Singapore. Overnight halt—maintenance crews of Qantas get busy, preparing for the next day's run—Batavia, Darwin, Sydney. The Lancastrian cruises at 240 m.p.h. for easily more than 2,000 miles.

Nevertheless, although the promise is great, the achievements so far are small. The crying demand for air links, for passengers and freight, in the East Indies points the way to a sort of Seven Seas Corporation though that may politically be asking too much in these corny days.

The third conversation at the "summer palace" mess of the R.N. Air Station at Sembawang (about 12 miles from Singapore) concerned the Navy's air transport service for the East—one nice little Auster.

Of course, base and squadron Firefly aircraft are available for air transport of selected



Kallang Airport, Singapore. A magnificent example of municipal enterprise.

customers, but anything approaching Neville Stack's almost private airline, which he operated for the Navy at Trincomalee with such success, using American aircraft, has completely vanished from the scene.

Now this is a very sore point with those who have grown up with naval aviation, since you can't run a railway without shunting engines, nor a harbour without routine boats, nor even an airport without transport cars. How, then, they ask, can you run an air force without communication aircraft?

The official answer is that if the Navy wants air transport, all it has to do is to ask Transport Command of the R.A.F., or at least ask the R.A.F. to supply the aircraft needed for particular journeys.

How this worked out in practice during the war can be seen by the fact that the Fleet Air Arm was forced in the end to run its own airline from Donibristle to the Orkneys, and to operate Stack's "private" airline in Ceylon. Meanwhile, in crucial days in the Eastern Mediterranean, when Admiral Cunningham wanted air transport to Cairo from Alexandria, he had to ask Heliopolis to send a Q.6 to Dekheila and thus make a double journey each trip.

Mr. Charles Taylor (right), Fairey's representative, with Lieutenant (E) Bouwer, R. Neth. Navy, and the Warrant Officer in charge of No. 860 Sqdn. Fireflies at Souravoya.

After many months of battling for one aircraft for naval communication, a Proctor finally arrived. This, unfortunately, crashed on its second flight, and thereafter those who had tried so long and so hard to secure a communication aircraft gave up the unequal struggle and relied on Swordfish or Walrus to do the job. It was an instructive sight to see seven staff officers climbing into a Walrus, and on at least one occasion four were flown in a target-towing Stringbag.

It was also instructive to read the excellent talks given recently by distinguished officers on Naval Aviation at the Royal Aeronautical Society. No reference at all, as far as I could see, was made to the need for a transport and communication service for the Fleet Air Arm.

This may be due to the smart felt in the Admiralty by an abortive attempt to start such a service in 1943. After a great paper battle with the Air Ministry, with M.A.P. striving to keep the peace, finally the Navy was offered (I think) eight Warwicks. Admiral Bell Davies presided over the meeting following this news, and the general opinion of the aviators present was that this was a small enough offer but at least a start.

Cdr. K. W. Beard, R.N., Commander at the R.N. Air Station, Sembawang, 12 miles from Singapore City. Cdr. Beard is one of the old-time Fleet Air Arm Observers.

Alas! This scheme died at birth. Almost at once the Warwick tally was reduced to two aircraft; but much more than this, the Directorate of Naval Stores weighed in with the killing demand that if the Fleet Air Arm started its own naval air transport service then the capacity should be available to all sections of the Navy. And even before the astonished hearers had recovered breath, as they saw their hopes of flying naval air stores to carriers abroad dashed or horribly diminished, the stores men blandly asked whether a Warwick could carry a 6in gun barrel as these were urgently needed at the Cape.

The trend of economic and political events in the Great East is such, in my opinion, that the defence of the zone and the military control of lawlessness must rest on sea power which is as indissolubly linked with air power in these parts as elsewhere. Singapore, changed in status after the inglorious collapse in 1942, is nonetheless the nodal point of communications for the area. Since the two nearest naval bases are Ceylon in the west and Hong Kong to the north-east, and both many hundreds of miles from Singapore, it is only common sense that a naval air transport service should come into being at that central base.

Otherwise, it will be just like old times, with the situation pre-war at Hal Far, Malta, duplicated in almost every detail—to the great disadvantage of the defence plan and the maintenance of order over a restive and rising section of the world. For, in the memorable words of General Smuts, spoken nearly three decades ago, in the Great East: "The tents have been struck—the Great Caravan of Humanity is on the march again."

AMPHIBIANS IN THE ANTARCTIC

MR. JOHN STRACHEY was the guest of honour at Mr. John Grierson's lecture to the Royal Geographical Society on June 2nd, and among those present was Sir Henry Self. It is to be presumed that the one represented gastronomic considerations, the other aeronautical. A very useful contribution was made by Mr. Hugh Lamb, the Air Ministry meteorologist, who was able to surmise, from his weather observations, that there is probably in the Antarctic a mountain range running north-south in a certain area, which has never yet been plotted on any map. This was related to an exceptionally good weather area between 104 and 108 deg E.

The lecture began with a brief description of the different types of whale found in the Antarctic. This was followed by an historical sketch of whaling and a description of the 1946-47 equipment of the *Balaena*, including the Walrus amphibians and the precautions taken to ensure the safety and well-being of their crews in case of a forced landing or other mishap. (It may be recalled that in our issue of March 27th, 1947, we published an article on this subject, sent us by Mr. Grierson while he was still on board the *Balaena* in the Antarctic.)

After describing the training of aircrews, and the experimental catapult launchings, Mr. Grierson explained the nature of the work on the scene of operations. From the aeronautical point of view his account was chiefly interesting in showing the good results obtained, the ease with which whales could be spotted from the air, and the complete satisfaction given by the Walrus amphibians and their Bristol engines. "Even to-day, thirteen years after its original design, this machine is as good as any in the world for the type of work we were doing," Mr. Grierson said.

A rough uncut film taken during the expedition illustrated how well whales can be seen when they are surfacing, or even swimming some 30ft below the surface. In spite of their size, the movements of these huge animals are extremely graceful. Mr. Grierson reported that whales had been seen, on the surface and under water, from heights as great as 10,000ft.

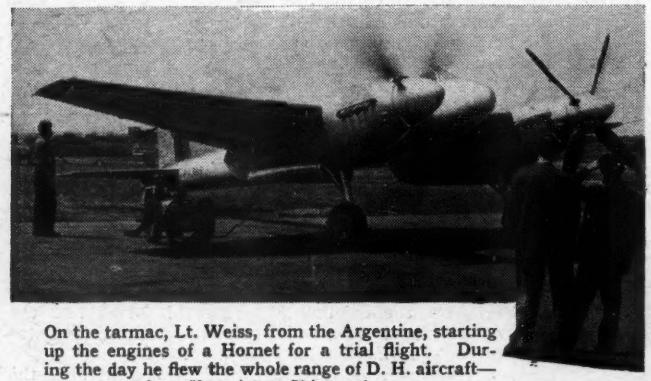
ACTIVITIES AT HATFIELD

A TOUR through any aircraft factory always provides a number of points of interest, particularly so when it is a concern such as D.H.s, where there is always a wide variety of products coming through the shops.

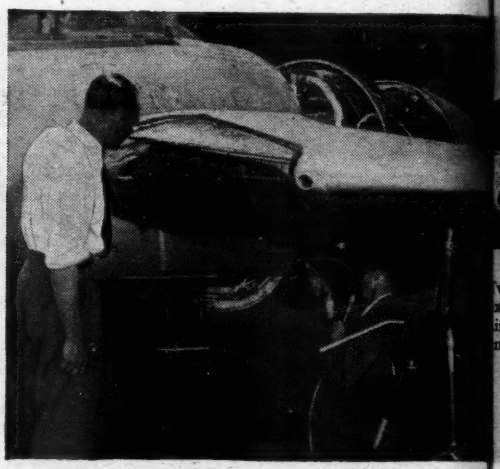
On the flight-test line there were Vampires and Hornets awaiting their turn with Doves and Mosquitoes, many of the latter being painted in the brilliant yellow of all training aircraft.

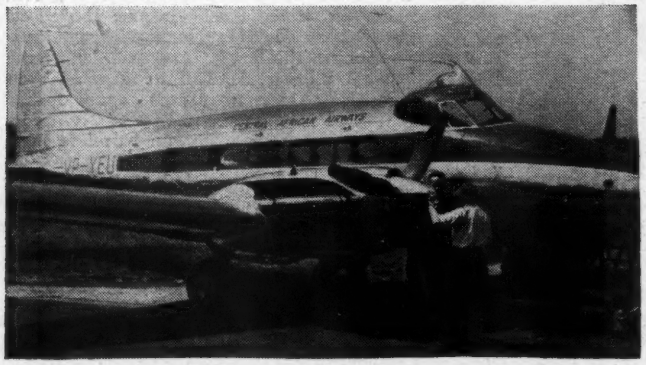
In the experimental department jet propulsion was to the fore with Ghost engines being installed in Vampires and a Lancastrian. Of the D.H.106, which is expected to do such great things, there is nothing yet shown even to the most privileged visitor. A decompression chamber is, however, now in operation, obtaining experimental data for the 106.

J. Y.



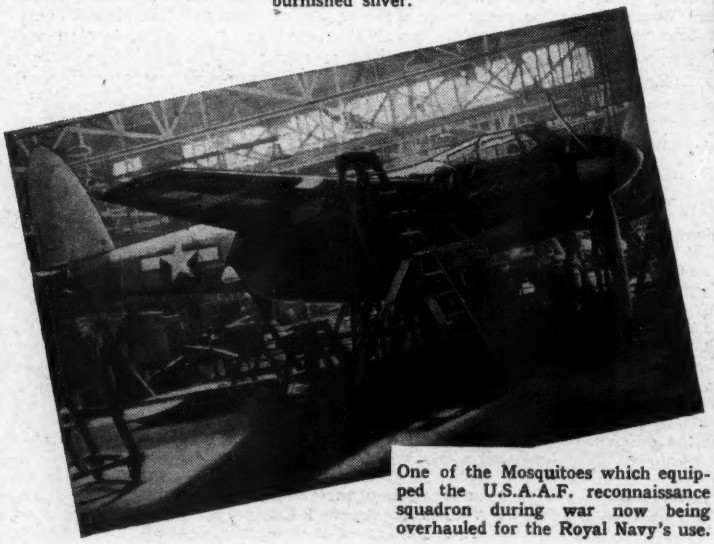
On the tarmac, Lt. Weiss, from the Argentine, starting up the engines of a Hornet for a trial flight. During the day he flew the whole range of D. H. aircraft—from Vampire to Chipmunk.



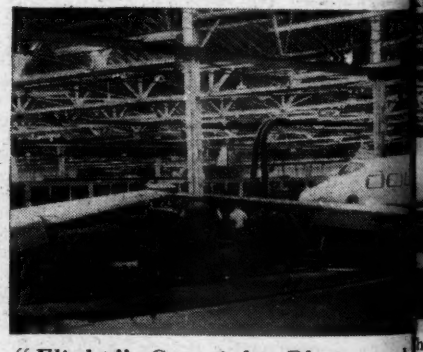


A Dove for Central African Air Lines has its engines run up for the first time. This aircraft looked very attractive in blue and burnished silver.

The occupant of the prototype Chipmunk gets a lit anxious as the gang mower cuts things a bit fine. Tw more Chipmunks have just arrived in Britain fr Canada.

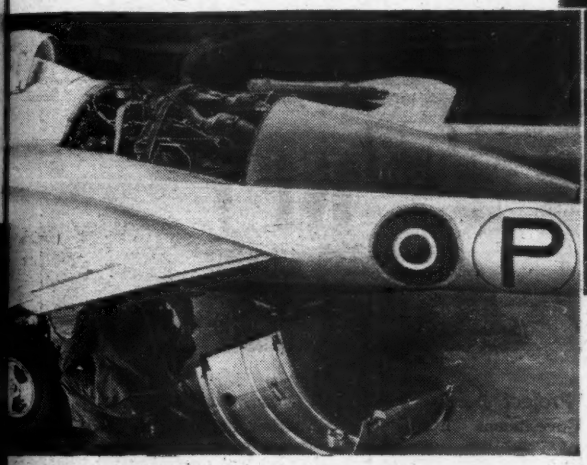


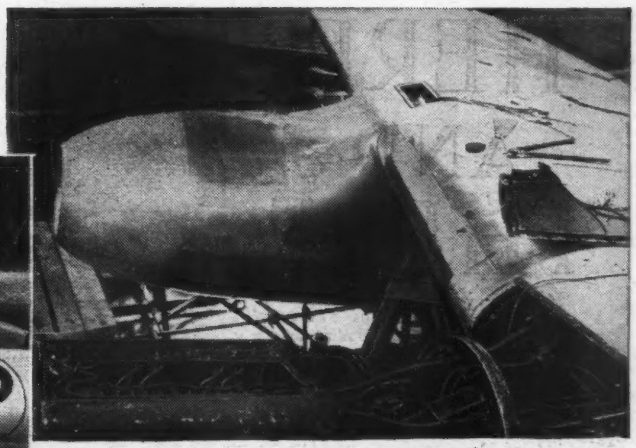
One of the Mosquitoes which equipped the U.S.A.A.F. reconnaissance squadron during war now being overhauled for the Royal Navy's use.



"Flight" Copyright Photograph

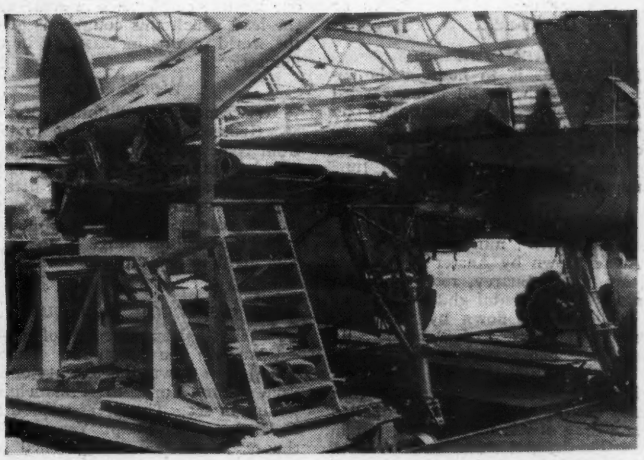
Some News and Views from a Walk Round the Shops and Tarmac of de Havilland's Aircraft Factory



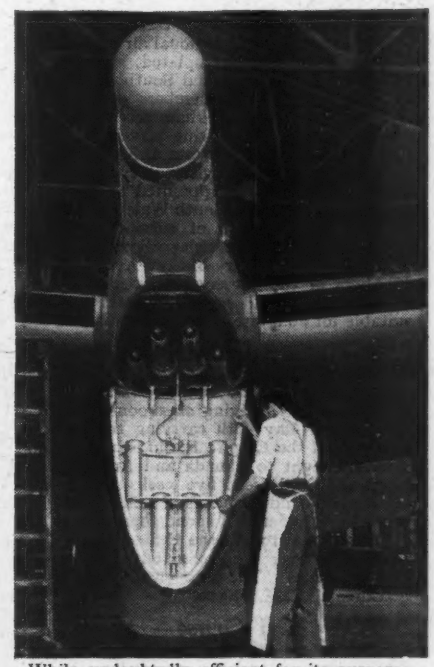


More silent flight. A Lancastrian in the experimental shop being fitted with D.H. Ghosts in place of the outboard Merlins.

Two views (left and above) of the D. H. Ghost being installed in an experimental Vampire. It is interesting to note that leading edge air intake ducts, as in the Goblin-engined version, are still being employed. The Ghost installation appears to result in a rather bulbous fuselage.



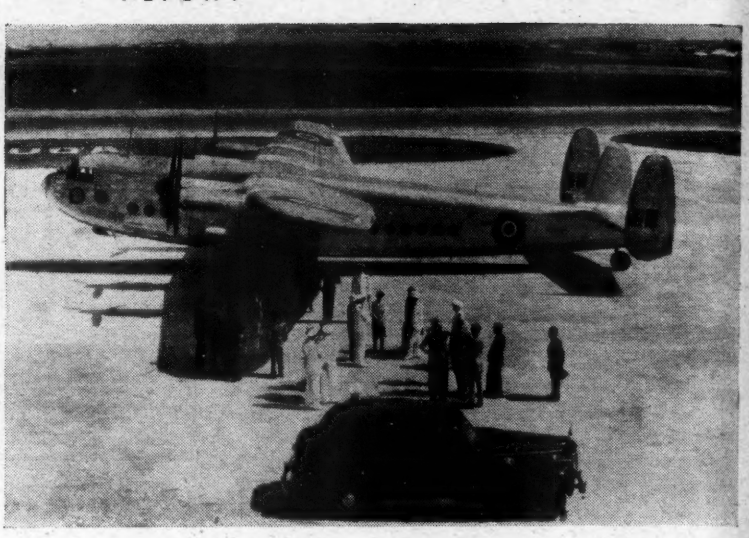
Testing the oleo wing-folding and undercarriage retraction of a Hornet on the production line.



While undoubtedly efficient for its purpose, not even its best friend could call the radar nose of the night-fighter Hornet handsome.

The Dove erecting shop begins to make a brave showing. On the right are fuselages being assembled and on the left is the moving production line.

HERE AND THERE



NOBLE YORK: ***The Viceroy of India,*** **Lord Louis Mountbatten's York aircraft on the tarmac at Luqa Airport, Malta, after the Viceroy had alighted for a two-hour halt *en route* for New Delhi. The York is the actual aircraft used by Lord Mountbatten throughout the Burma campaign.**

Wales Needs Air Service

THE formation of a regional air council for Wales is contemplated. Representatives from North and South Wales, including M.P.s and members of local authorities, met at Wrexham recently to consider ways of improving travel facilities in the country by establishment of an air service. A provisional executive for North Wales was appointed to work in conjunction with a South Wales executive with an object of submitting a memorandum to the Welsh parliamentary party and the Ministry of Civil Aviation. Members of the conference agreed that the R.A.F. airfield near Wrexham was suitable for adaptation as a civil airport.

Radio School Mission

A STANDARD Lincoln II bomber, *Mercury II* (the Halifax *Mercury I* is now used as a flying classroom), left England on May 28th carrying thirteen members of the Empire Radio School on a liaison flight to Canada and America, where they will spend five weeks discussing methods and problems of radio training. The mission will spend three weeks in Canada and two in the United States, and will cover approximately 13,000 nautical miles. The mission is led by A. Cdre. T. P. F. Fagan.

Off Course

A GERMAN V.2 rocket, fired in the direction of the desert region to the north from the U.S. Army's proving grounds in New Mexico, veered south and landed in Mexico two and a half miles from the centre of the town of Juarez.

One Australian Project . . .

THE Australian Government has authorized the expenditure of £965,000 on the purchase of machinery plant, machine tools and the erection of a new test house in connection with the plan to produce Rolls-Royce Nene jet engines in Australia. The Commonwealth Aircraft Corporation has been given the contract to construct sixty of these units for use in Vampires to be built by de Havillands.

. . . And Another

THE R.A.A.F. is to help in the intensive search for oil being carried out by the Australian authorities by making a photographic survey in the Broome area of West Australia. The survey was scheduled to begin on June 1st and will cover 5,000 miles.

Tug Tug !

A STANDARD military Mark VI Auster flown by Auster's chief test pilot, Mr. G. N. Snarey, recently towed a Slingsby experimental glider known as TX8. The glider, flown by Mr. John Leach, chief engineer of Slingsby Sailplanes, Ltd., has a wing span of 54ft, just 1½ times the span of the tug machine. It is interesting to note that the drag of this 1,000 lb glider equalled the total drag of the tug aircraft, but in spite of this the glider was towed to over 6,500ft and reached a level flight speed of 80 m.p.h. The "cost" in drag of the 100 yds. tow rope with inter-com. wires attached externally, was 12 m.p.h.

A Show of Precision

AN exhibition designed to show the importance of scientific instruments in everyday life was opened at the Charing Cross Underground station on Tuesday, June 10th.

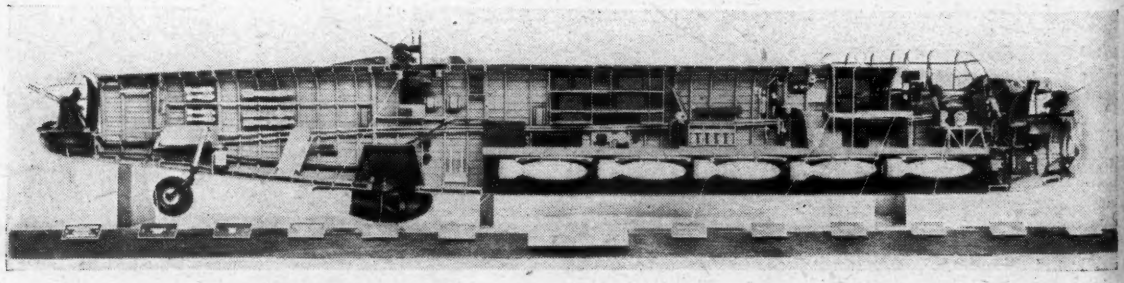
Organized by the Ministry of Supply in collaboration with the Scientific Instrument Manufacturers' Association, the exhibition, which will remain open for one month, emphasizes in some measure the lead which this country is giving to the world in this increasingly important industry.

World Trip

TWO Americans, Clifford V. Evans and George E. Truman, are to take off from New York shortly on a round-the-world flight in two Piper type PA-12 aircraft. The machines will be fitted with wing tanks enabling them to carry a total of 128 gallons, providing a 26-hour duration or a still-air range of 2,392 miles. The flight is expected to take about ten weeks.

American Jet Figures

A JET fighter aircraft of the U.S. Army, the Republic Thunderjet (P.84), has flown the seventy-one miles from New York to Philadelphia in 7 min. 11 sec. This gives a speed of just under 600 m.p.h. Capt. Yeager, who flew the machine, said he switched on the timing instrument over the Empire State Building, New York, and stopped it as he passed Philadelphia's City Hall. Readers will recall that S/L. Cotes-



FOR INSPECTION: The above photograph shows the 1/12th scale sectional model of the Avro Lancaster bomber Mk III recently presented by A. V. Roe and Company, Ltd., to the Science Museum, South Kensington, London. It now forms part of the national aeronautical collection.

HERE AND THERE

Preedy flew a Gloster Meteor IV from Brussels to Kastrup at an average speed of 630 m.p.h. (mentioned on this page in *Flight* of May 1st).

Russian Medical Services

WE hear from Moscow that Russia is expanding and speeding up her medical services with the use of air transport. Air service stations have been opened up in the remote districts of the country, and we understand that in the first four months of this year Soviet aircraft flew a total of 25,000 hr on medical missions and transported several thousand doctors and patients.

Lectures for B.E.A.

ABOUT fifty members of the staff of B.E.A. who come into close contact with international problems are to attend lectures arranged by the Royal Institute of International Affairs. The opening lectures are to deal with Western Europe, covering events in France, Belgium, the Netherlands and Switzerland.

De-icers Increase Speed!

A REPORT that a 20 m.p.h. gain in air speed had been noted when wing de-icers were turned on in the DC-6 was received sceptically at the Douglas works. However, since test flights verified the phenomenon, a survey has been set up to investigate and gather further information.

Air Force Artist

UNDERGOING training in the R.A.F. during the war, Norman Wilkinson was stationed at the Metropole Hotel, Brighton. Whilst there he painted murals on the blank walls of the hotel. Recently Mr. Wilkinson returned to the Metropole as a Manchester industrial designer, and finished off some of the paintings he started there during the war. Readers will recall that we published one of his paintings in our issue of February 6th; another is shown on this page.

GOBLIN BLUEBIRD: Sir Malcolm Campbell looks cheerfully confident as he sits in the original record-breaking Bluebird II, which has now been fitted with a de Havilland Goblin jet engine in preparation for Sir Malcolm's attempt on his own world's water speed record (141.74 m.p.h.).

Australian Enterprise

INTER-CONTINENTAL AIR TOURS is a company formed by three Sydney men operating charter air services from Australia to Britain. The company are endeavouring to make air travel between Australia and England a luxury affair, with no priorities, no dawn starts and no bad-weather flying. Passengers will be able to stay overnight at an hotel or club and see the show spots on the route.

Carrying the Banner

A PEACETIME use has been found for two Fairey Swordfish by Mr. E. McConnell in Johannesburg. Mr. McConnell is using these aircraft to tow advertising banners which, he says, are 7ft high, 300ft long, and weigh 200 lb in all. Referring to the Swordfish, Mr. McConnell adds: "There seems to be no limit to the amount I can tow."

Loan

THE United States export-import bank has announced that it has advanced a credit of over three million dollars (£750,000) for the purchase of nine Lockheed Constellations by K.L.M.

Pipelines by Air

YET another unusual task has been successfully accomplished by helicopters. News has reached us from Washington that these "jack of all trades" machines have been used in the U.S.A. for laying petroleum pipelines. The report states that aluminium piping and reinforced hose of a type used towards the end of the war were employed in the experiments.

News in Brief

ONE of the two Czechoslovak Falcon aircraft which left Prague on April 1st for a return flight to Capetown (reported in *Flight*, April 17th) landed back at Prague last week. The pilot was Mr. Frank Mlejnecky, who served with the R.A.F. during the war.

* * *

Mr. L. M. Haybittel, formerly a director and general manager of Wrightways, Ltd., has now joined British European Airways as freight manager.

* * *

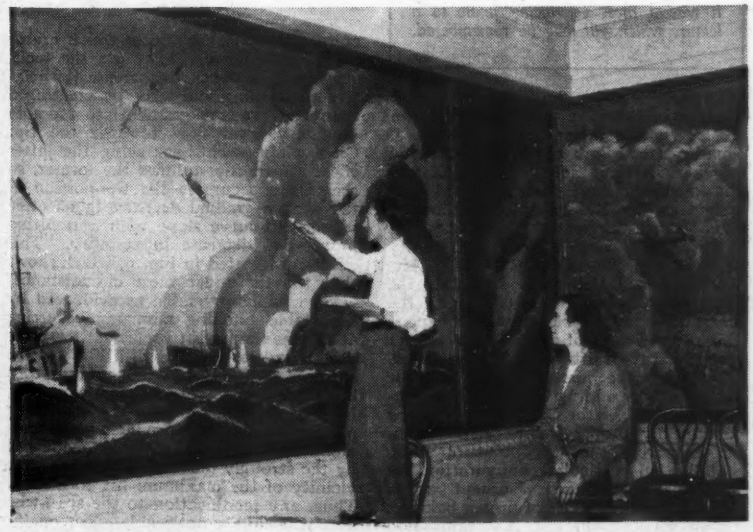
The committee of the Headquarters Bomber Command Association of Officers announce that the Association's reunion for 1947 is to be held at the Officers' Mess, Headquarters Bomber Command, R.A.F., High Wycombe, Bucks, on July 5th. Particulars may be obtained from the Hon. Sec., H.Q.B.C. Association of Officers, R.A.F., High Wycombe, Bucks.

* * *

A further donation of £500 has been made by the Dunlop Rubber Company to the British United Aid to China fund.

* * *

Mr. A. C. Wickman has resigned his position of managing director of A. C. Wickman, Ltd., but remains chairman of the company. Mr. G. C. Trowbridge becomes managing director.



WAR PAINTINGS: Ex-R.A.F. Sergeant-Pilot Norman Wilkinson, watched by his wife, puts the finishing touches to one of his murals in the Hotel Metropole, Brighton, where he was stationed during his R.A.F. training period.

ALL-WING AIRCRAFT

Part II of the Wilbur Wright Lecture Read Before the R.Ae.S. by J. K. Northrop

(Continued from p. 531)

DURING all the time that development and testing of other types and scale versions of the XB-35 had been progressing, the design and construction of the XB-35 itself had been under way N9M aircraft had proved the practicability of the design. They closely approached the XB-35 configuration but mounted only two pusher engines located at points corresponding to mid-way between engines 1 and 2 and engines 3 and 4.

The problem of control surface actuation on the big bomber involved the development and testing of a complete hydraulic control system, as none of the aerodynamic boosts or balances developed and tested in the N9M models had proved satisfactory. The system used in the XB-35 employs small valves which are sensitive to comparatively minute movement of the control cable and which, when displaced, permit large quantities of oil to flow into the actuating cylinders. This arrangement eliminates any "feel" of the load unless a deliberate arrangement for force feedback is made. Rather than undertake this latter step a comparatively simple

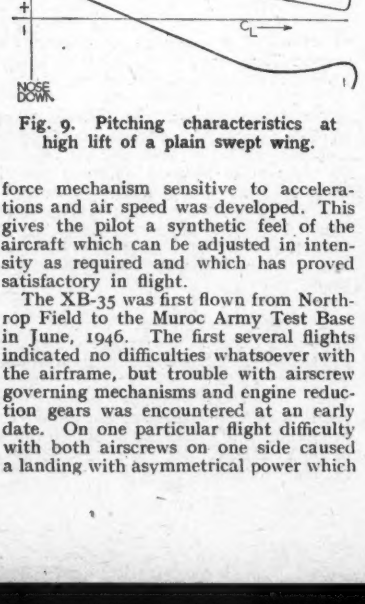


Fig. 9. Pitching characteristics at high lift of a plain swept wing.

force mechanism sensitive to accelerations and air speed was developed. This gives the pilot a synthetic feel of the aircraft which can be adjusted in intensity as required and which has proved satisfactory in flight.

The XB-35 was first flown from Northrop Field to the Muroc Army Test Base in June, 1946. The first several flights indicated no difficulties whatsoever with the airframe, but trouble with airscrew governing mechanisms and engine reduction gears was encountered at an early date. On one particular flight difficulty with both airscrews on one side caused a landing with asymmetrical power which

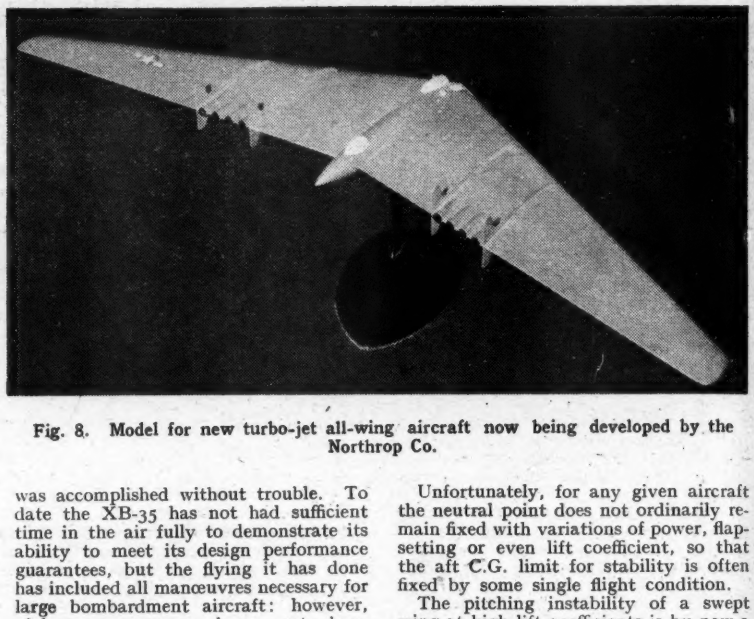


Fig. 8. Model for new turbo-jet all-wing aircraft now being developed by the Northrop Co.

was accomplished without trouble. To date the XB-35 has not had sufficient time in the air fully to demonstrate its ability to meet its design performance guarantees, but the flying it has done has included all manœuvres necessary for large bombardment aircraft: however, violent manœuvres have not been attempted and no exact evaluation of stability and control parameters has been possible.

Two turbo-jet powered all-wing aircraft, having the same basic shape and size as the XB-35 are now virtually complete and will be flying this summer. Each is powered by eight jets having a sea-level static thrust of 4,000lb apiece. Small vertical fins are incorporated to provide the same aerodynamic effect as the airscrew shaft housings and airscrews of the XB-35. Fig. 8 shows a model of this aircraft.

IN our last week's issue we gave the first part of the Paper presented to the Royal Aeronautical Society by John K. Northrop, head of the famous American aircraft firm which bears his name, as the 35th Wilbur Wright Memorial Lecture. The concluding elements of Mr. Northrop's lecture are given on this and the succeeding pages.

Unconventionally, the lecturer devoted the final 15 minutes of his hour to presenting a film showing various Northrop all-wing gliders and powered aircraft. It was a most convincing finale to a lecture which will long be remembered.

Turning to considerations of stability and control in all-wing aircraft, Mr. Northrop said that in any aircraft the primary parameter determining the static longitudinal stability is the position of the centre of gravity with respect to the centre of lift or the neutral point. Obviously, the neutral point may be shifted aft by adding a tail or by sweeping the wing, or the C.G. may be shifted forward by proper weight distribution, so that from the standpoint of static stability no particular configuration has any special advantage except as it affects the possibilities of proper balance. In an all-wing aircraft the elimination of the tail makes the problem of balance somewhat more critical but not excessively so.

Unfortunately, for any given aircraft the neutral point does not ordinarily remain fixed with variations of power, flap-setting or even lift coefficient, so that the aft C.G. limit for stability is often fixed by some single flight condition.

The pitching instability of a swept wing at high lift coefficients is by now a somewhat familiar phenomenon. The mechanisms involved, however, are still somewhat obscure. There are apparently two opposing effects which are of prime importance. They are the tendency for sweepback to increase the relative tip loading and also (by creating a span-wise pressure gradient) to promote boundary layer flow towards the tip. On a plain swept-back wing the latter effect apparently nullifies the former, so that there occurs in the tip portion of the wing a gradual decrease in effective section lift-curve slope with a resulting progressive decrease in stability. This effect is indicated in Fig. 9, which shows that the tip under these circumstances never completely stalls, as evidenced by the stable pitching moments occurring at the maximum lift coefficient. On the other hand, as illustrated in Fig. 10, the addition of end plates will prevent to a large extent the effects of span-wise flow, thereby straightening the pitching moment curve but producing the normally expected tip stall, as evidenced by the strongly unstable moments in the vicinity of the maximum lift coefficient. Thus, any modification to the span-wise flow will have a noticeable effect on the pitching behaviour at high lift coefficients.

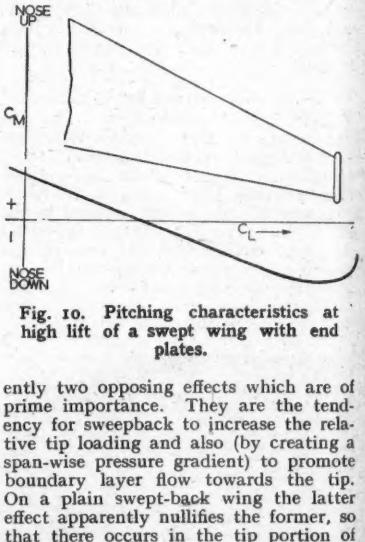


Fig. 10. Pitching characteristics at high lift of a swept wing with end plates.

In the case of the XB-35 the airscrew

shaft housings deter span-wise flow and straighten out the moment curve below the stall as in the case of the end plate; but in order to obtain stability at the stall a tip-slot is provided to increase the stalling angle of the tip sections. These effects are illustrated in Fig. 11, which also shows that by raising the trim flap in the outer 25 per cent span and lowering the main flap in the inner 35 per cent span, the stability characteristics are noticeably affected, presumably because of a decrease in span-wise pressure gradient and therefore in boundary layer flow.

The possibility of controlling the

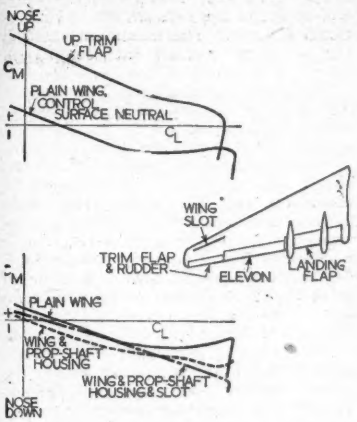


Fig. 11. Effect of various devices and control surface deflection on XB-35.

stalled portions of the wing, as outlined, means that trailing edge flap controls can be laid out to maintain their effectiveness at very high angles of attack. Since a certain portion of this flap must be used to provide high lift and roll control, the amount available for longitudinal trim is limited, so that for the XB-35, for example, the total available nose-up pitching moment coefficient is 0.15 as compared to 0.30 for a conventional aircraft. This limited control, plus the fact that the main wing flaps apparently cannot be made self-trimming and impose a diving moment in the landing condition, reduces the available C.G. range in per cent of the m.a.c. as compared with conventional aircraft. The XB-35 has a C.G. range of only 5 or 6 per cent as compared with conventional values in the order of 10 or 12 per cent. This comparison is somewhat misleading, however, because the all-wing aircraft may have a greater comparative m.a.c. in view of its somewhat lighter wing loading. It is also much easier to arrange weight empty and useful load

TABLE I

Derivative (per radian)	XB-35 $C_L = 0.3$	XB-35 $C_L = 0.6$	Conventional C_L — Cruise
$C_{n\beta}$ Weathercock stability	0.020	0.026	0.060
$C_{l\beta}$ Effective dihedral	−0.029	−0.057	−0.070
$C_{y\beta}$ Side force ...	−0.050	−0.075	−0.600
C_{nr} Damping in yaw	−0.007	−0.010	−0.080
C_{np} Yaw due to rolling ...	−0.011	−0.022	−0.050
C_{lr} Roll due to yawing ...	0.06	0.12	0.15
C_{lp} Damping in roll	−0.44	−0.44	−0.45

items span-wise within close m.a.c. limits than in conventional types.

It is when considering the lateral stability and control factors that the difference between the all-wing and conventional aircraft becomes most apparent. The accompanying table compares the XB-35 factors with those of a conventional aircraft.

Definite requirements for the weathercock stability $C_{n\beta}$, depend to a large extent on the aircraft's purpose, but positive weathercock stability is always required. The swept-back wing has inherent directional stability which increases with increasing lift coefficient; but this is not considered sufficient for satisfactory flight characteristics under all circumstances and must be supplemented by some additional device. The wing-tip fin has been favoured by some since it gives the largest yawing lever arm and provides a suitable rudder location. However, as previously pointed out, wing-tip fins may be unsatisfactory at the stall. For the XB-35 configuration, effective fin area is provided in large measure by the side force derivative of the pusher airscrews.

Rudders for all-wing aircraft are perhaps the chief control difficulty. Unless large fins are used a conventional rudder cannot be employed. If large fins and rudders are used, an objectionable adverse side force due to rudder is inherent, since the rudder moment arm is small and the side force comparatively great.

Of the many types of drag rudder investigated, a simple double-split trailing-edge flap at the wing tip has been found to have the most satisfactory all-round characteristics. This arrangement permits the simplest construction and allows combination of trim flap and rudder in the same portion of the trailing-edge. One disadvantage of this type is its comparatively low effectiveness at low angles of rudder deflection, which

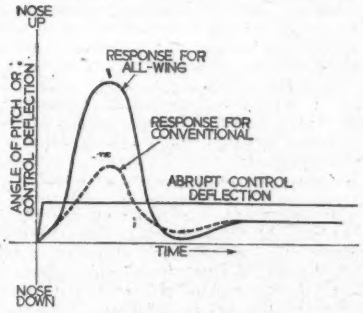


Fig. 12. Response of all-wing and conventional aircraft to elevator control.

may be remedied by the employment of a non-linear pedal-to-rudder linkage in the case of power-operated rudders

In considering the effective dihedral $C_{l\beta}$, the lecturer continued, it is apparent that sweepback is the essential difference between the all-wing and conventional aircraft—a difference that will disappear as flight speeds increase and it becomes necessary to employ the desirable high-speed characteristics of swept wings in conventional tailed configurations. For swept-back wings $C_{l\beta}$ increases quite rapidly with lift coefficient which gives difficulty only when its value becomes too large. It is unimportant for either flight ease or for dynamic stability and control characteristics when it is near zero.

All-wing aircraft, particularly those without fins, have a very low cross-wind derivative; thus a low side force results from side-slipping motion. Some cross-wind force is probably important for precision flight, such as tight formation flying, bombing runs, gun-training manœuvres, or pursuit. This importance arises because with low side force it becomes difficult to judge when side-

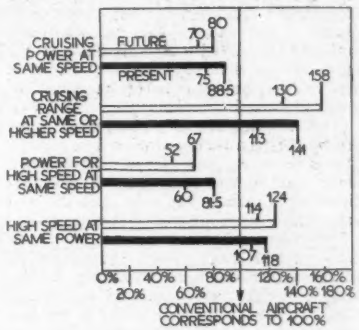


Fig. 13. Graph of performance characteristics of all-wing aircraft.

slip is taking place, as the angle of bank necessary to sustain a steady side-slipping motion is small. This lack of side force has been one of the first objections of pilots and others when viewing the XB-35. After flying in the N9M or XB-35 the objection is removed, except for some of the specific cases mentioned above. For the correction of the lack of sideslip sense, a sideslip meter may be provided for the pilot or automatic pilot, and for very long-range aircraft there is a valuable compensating advantage in being able to fly under conditions of asymmetrical power without appreciable increase in drag.

The criterion of response is probably the only category in which the flying wing is importantly different from the conventional aircraft for longitudinal motion. The action of the two types in an abrupt vertical gust is especially interesting, two factors combining to reduce the accelerations experienced by all-wing aircraft. These factors are the relatively larger wing chord, and shorter effective tail length of the all-wing type. The first increases the time for the transient lift to build up and is the more important in reducing accelerations. The second decreases the time interval between the disturbing impulse at the effective tail, so that the aircraft tends to pitch into the gust. This latter characteristic is a matter of concern to pilots, since a disturbance in the air is likely to leave them farther from trim attitude, consequently requiring more active pilot control in rough air. It is believed, however, that automatic control will effectively eliminate this difficulty.

The response of the all-wing aircraft to elevator deflection seems entirely adequate. It errs, if at all, on the side of over-sensitivity because of low C_{m_q} and low moment of inertia in pitch. Fig. 12 illustrates this effect. As is seen from the curves, an abrupt control movement giving the same final change in trim speed for a conventional and a comparable all-wing aircraft results in a larger initial swing in pitch for the all-wing.

As in the longitudinal motions, the amplitudes of response of an aircraft in lateral motion are probably as important as the damping rates in determining free-flight characteristics. All-wing aircraft seem slightly rougher in turbulent air than conventional aircraft of similar weight. This is due chiefly to the reduced wing loading, but high effective dihedral and low weathercock stability may have an added effect. This is a matter of interest in fixing upon analytical criteria for the description of free-flight qualities. As mentioned above, increasing the weathercock stability for all-wing aircraft has a slight effect on the damping rates; however, it affects the amplitudes of response to gusts materially.

The application of automatic pilot control to an all-wing aircraft has certain difficulties which are associated primarily with the low value of $C_y\beta$. In conventional applications the fact that the aircraft is side-slipping is detected by either a lateral acceleration or an angle of bank. In an all-wing aircraft neither of these indications exists except in an almost undetectable amount. Accordingly, it is necessary, in order to fly the aircraft at zero sideslip, and therefore in the direction of its centre line, to provide a yaw-vane signal to which the pilot or automatic pilot will respond. This introduces some difficulty in automatic pilot design because for small disturbances the sideslip angle with respect to the wind, and the yaw angle with respect to a set of fixed axes, are nearly equal and opposite for a flying wing. The customary automatic pilot control on azimuth angle therefore tends to oppose the necessary control on sideslip. To avoid this difficulty it is necessary only to reduce the rate of control on sideslip to approximately one-third that on azimuth. This modification to a conventional automatic pilot was flown on the N9M with complete success.

As has been pointed out previously, the permissible range of C.G. location is not overly critical in all-wing aircraft. It is, nevertheless, of great advantage to be able to load the aircraft almost at will, without concern as to how the useful load is disposed and the swept-back configuration lends itself most suitably to such loading.

XB-35 Load Distribution

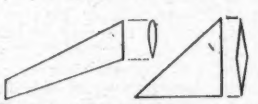
In the case of the XB-35, the useful load, consisting largely of bombs and fuel, can be readily disposed in suitable positions about the C.G. While some fuel is located well forward and some well aft of the desired C.G. location, under normal operating conditions the proper balance is readily maintained. In case of failure of one or more engines, it is necessary to pump the fuel from unused tanks to those supplying the remaining engines, but a simple manifolding system provides this facility.

Based on a great many studies of various types and applications of the all-wing principle, some practical limitations may be approximately defined. Where very dense (high specific gravity) paylcads are contemplated, such as warheads or similar munitions, quite small units are practical, as demonstrated by the all-wing buzz bombs to which reference has been made. Medium-sized units having a span of perhaps 100ft and a gross weight of 50,000 to 60,000 lb appear entirely practical for medium

ALL-WING AIRCRAFT

bombers and freighters. Here again the density of the useful load, both in payload and fuel, is comparatively high.

An aircraft of the XB-35 configuration and size can carry 50 passengers in comfort in the existing aerofoil envelope with adequate headroom for all, and with vision forward through the leading edge, downward through windows in the floor, and upward if desired. Passenger vision in a flying wing may be more satisfactory than in conventional types if we get used to the idea of forward vision rather than that provided by side windows. The really interesting views are likely to be forward and downward rather than to the side. An aircraft like the XB-35 will have cargo space for 40,000 to



	CONVENTIONAL	DELTA
Thickness a: Root	I	I
Taper Ratio	2:I	∞
Thickness Ratio	15%	7½%
Aspect Ratio	8	4.5
Root Chord Ratio	I	2
Span Ratio	I	0.75
Volume Ratio	I	0.833

Fig. 14. Comparison of subsonic and supersonic all-wing aircraft.

50,000 lb of air freight at a density of 10 to 15 lb per cubic ft in addition to the necessary crew and space for 50 passengers.

"Turning to future possibilities," Mr. Northrop went on to say, "considerable further aerodynamic refinement can be made over that already accomplished in all-wing types. Particularly if turbojets are used as the motive power, the minimum parasite drag may be reduced to 0.008 or less. Boundary layer removal and the use of somewhat thinner wing sections may further appreciably reduce this figure.

"A maximum trimmed lift coefficient of 1.9 for the all-wing configuration seems attainable by methods already suggested and possibly may be further increased by judicious use of boundary layer control in combination with turbojet power plants. It is our opinion that the ratio of C_{Lmax} to C_{Dmin} may be increased to a value of 235 within the not-too-distant future from our present actual achievement of about 130. In contrast, the years of intensive development of the conventional types already passed promise an improvement of less magnitude within a comparable time. In our judgment a trimmed maximum lift of 2.8 vs. a minimum drag of 0.020 seems reasonable to expect for large, long-range transport and bombardment aircraft of conventional type.

"These estimates are, of course, completely arbitrary and controversial. However, if one cares to assume their validity, the following conclusions may be reached, based on methods and calculations used in the early part of this paper. The total minimum profile drag on the all-wing aircraft in terms of the conventional will be from 40 to 59 per cent. The power required by the all-wing to maintain the same cruising speed as the conventional will be from 70 to 80 per cent and, conversely, the maximum range of the all-wing, at the cruising speed of the conventional aircraft, will be 143 to 125 per cent. The maximum range of the all-wing aircraft at *its* best cruising speed will be 158 to 130 per cent of the conventional, and the most economic speed will be from 125 to 115 per cent faster.

"Under high-speed conditions corresponding to full power of reciprocating, turbo-prop or turbo-jet engines, where the induced drag is assumed to be 20 per cent and the parasite drag 80 per cent of the total, the power required to drive the all-wing aircraft at the speed of the conventional aircraft will be 52 to 67 per cent and, conversely, the range will be 192 to 149 per cent of the conventional aircraft. The maximum speed of the all-wing aircraft at comparable powers will be 124 to 114 per cent of its conventional counterpart. These values are shown in Fig. 13, to give an idea of what possibilities for improvement appear reasonable in the next few years.

"So far in this discussion we have purposely avoided transonic and supersonic considerations. This neglect is possibly a reasonable one when discussing commercial ventures, in view of the cost of higher and higher speeds. A reasonable degree of sweepback, such as is required in the type of aircraft under consideration, will permit speeds up to about 500 m.p.h. without involving great compressibility drag increases. For military aircraft, however, we cannot ignore the sonic 'barrier' and its implications, and it is a reasonable assumption that sooner or later improved fuels will permit higher and higher operational speeds, even in commercial aircraft.

"Based on present knowledge of supersonic flight, it will always be more difficult to carry a given payload for a given range at supersonic speed because of the additional wave drag encountered at these speeds. At transonic or comparatively low supersonic speeds a plain swept-back wing appears to be one of the best possible configurations, provided that sufficient volume is available within the wing. Since the flow normal to the leading edge is subsonic over almost the entire wing surface, subsonic aerofoils with reasonably good subsonic flight characteristics can be used at these speeds. The all-wing design eliminates wing-fuselage interference as well as adverse interference between the tail surfaces and wing or body.

Supersonic Types

"At higher supersonic speeds the problem of providing adequate volume is more difficult because more and more fuel is required for a given range, and the percentage thickness of aerofoils suitable for such use is much less than that satisfactory for subsonic flight. Save for one compensating factor, this problem of volume and size might well rule out the all-wing aircraft for supersonic use, and certainly does limit its usefulness for low-altitude flight. However, an attractive field of operation exists at very high altitude where air densities are low and, therefore, wing areas must be comparably great if suitable lift coefficients are to be maintained. If we design a frankly supersonic aircraft to fly at, say, a Mach number of 1.6 with supersonic diamond-section aerofoils, the maximum cruising lift coefficient will probably be no greater than 0.15, and the corresponding loading must be held to 40 lb per sq ft.

"The above figures are based on assumed

ALL-WING AIRCRAFT

operation at 60,000ft and an air density ratio of 0.094. Such an aircraft might likewise be suitable for landing and take-off at low altitude, in view of its comparatively light wing loading, which would eliminate the necessity of high-lift devices. The practicability of the design depends on the relative density of the air at the altitude selected for cruising operation. If a sufficiently high altitude is chosen, it seems quite possible that adequate volume can be secured in the wing, in spite of its small thickness ratio, by using low aspect ratio planforms approaching the triangular.

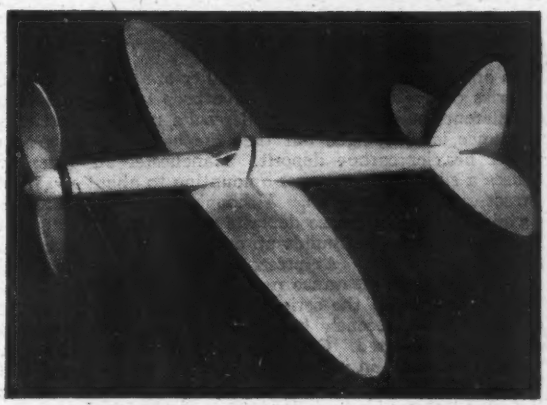
"Comparative data on two wings having the same physical depth at the root, and identical wing areas, are shown in Fig. 14. The conventional wing is of a type already proved practical for all-wing aircraft. The delta wing has thickness ratios suitable for supersonic flight, identical thickness and only slightly reduced volume. It should be quite suitable for all-wing aircraft of reasonable size. From the aerodynamic point of view it appears that with the delta wing it is possible to eliminate a substantial portion of the wave resistance and thus realize fairly favourable lift-drag ratios at supersonic speeds.

"It is gratifying to those of us who have been working on all-wing projects for years to recognize the increased interest in the type evidenced in Germany toward the end of the war, and more particularly in England and Canada in recent years. For many years we received scant encouragement and often seriously questioned our own judgment, as well as our ability to achieve a successful solution to the many problems involved in the development of this type. The goals and rewards have always seemed well worth attainment, however, and I believe accomplishments to date have justified the effort required.

"I hope this discussion may provide encouragement and incentive to those in Great Britain who have pioneered all-wing aircraft and that these projects, both here and in the United States, may profit by each other's mistakes and successes, thus bringing the two countries to the forefront in this important phase in the development of air transport."

Something New in Models

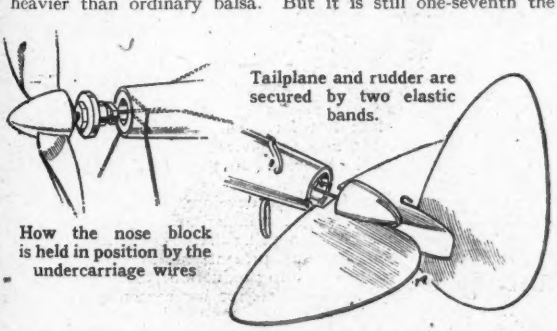
The Unirep Falcon is Moulded in "Balsaplast" : Unique Features



EVER since an American competitor won the "Wakefield Cup" competition in 1930 with a model constructed of balsa, this almost absurdly light, spongy wood has been the most popular material to be used by aeromodellers. But in its unadulterated state it has the disadvantage of a very low resistance to fracture; the ease with which it can be worked is matched by the ease with which it breaks.

Appreciating the ever-growing interest in model aircraft, two ex-R.A.F. officers, D. V. Jenkins and H. P. Parsbo, thought it would be a good idea to see if something could be done about improving the strength of balsa and, as recorded in *Flight*, September 26th last, they eventually evolved a material which they named Balsaplast. This, as the name implies, is balsa wood impregnated with a special plastic solution which makes it immensely stronger than "neat" balsa wood. Not unnaturally, the exact nature of the plastic used, and the bonding process, are trade secrets.

This very desirable increase in strength is not, of course, obtained entirely free of charge, and Balsaplast is somewhat heavier than ordinary balsa. But it is still one-seventh the weight of cork, and it has one very important additional advantage; it can be moulded.



Having perfected their new material, it was decided to go the whole hog and market a model aircraft, and a small factory has now been started in Cheltenham for this purpose. Messrs. Jenkins and Parsbo are joint directors of the firm, the name of which is Unirep Ltd., and their first model, which will soon be produced in numbers and distributed to the retail trade by Hargill & Co., also of Cheltenham, is called the "Falcon."

The Unirep "Falcon" has a number of unique features (the subject of a series of patent applications), in addition to being the only model aircraft moulded in Balsaplast, and *Flight* was able recently to inspect one of the prototype models, though there was no opportunity at the time to carry out any flying tests. But a feature of the distinctly clever design is that it provides for automatic rigging of the aircraft on assembly. The only exception to this is that a fairly generous choice of fore-and-aft settings is provided for the wings.

The fuselage of the "Falcon" is a moulded monocoque, oval in section amidships and with a Perspex cockpit cover, and tapering to a cylindrical section at nose and tail. Its only stiffening is provided by internal collars at each extremity to receive nose-block and tail-cone respectively, and production is simplified by making the tail-cone identical in size and shape with the spinner.

Reference at this point to the appropriate sketch will show how the nose-block is held in position so that, when the elastic motor has finished its run and is slack, the block and airscrew will remain *in situ*. The crossbar of the single-wire undercarriage passes through the nose of the fuselage at about a third of its diameter from the top, and another wire bar, the ends of which act as retaining clips for the undercarriage legs, also passes through the nose a like distance below the centre-line and parallel to the undercarriage crossbar. When the barrel of the nose-block is inserted it is turned so that two flats on its inner end allow it to pass between these two parallel wires and it is then turned again so that the wires are held in the groove between the barrel proper and the flat-sided flange.

The wings, of Spitfire shape, are single sheets of Balsaplast moulded to a fairly pronounced camber, and their roots are shaped to fit round the curved underside of the fuselage. The two wings are linked at their leading and trailing edges by cotton ties passing through wire loops bonded to the roots, the idea being that in the event of severe impact, the cotton ties will break and save the wings from damage. Across the centre of the chord between the wing roots is a wire "saddle," shaped to the fuselage belly and having an indentation on the centre-line which registers with a five-notch rack bonded into the fuselage. Immediately above the extremities of this saddle, at each wing root, is a wire hook, and the wings are held in position by an elastic band passing over the top of the fuselage. As the saddle is attached to each wing by a wire link, the wings can be folded together, and, with the tail surfaces also detached, the whole job stows away into its box most compactly.

The "Falcon" has a span of 28in and an overall length of 23in. Its total weight is 5½ oz and it has a wing-loading of 22 sq in/oz. Maker's performance figures give an average duration of 40 sec and a still-air distance of 250 yd.

Metrovick Progress

Type Test Completed for the F2 Series 4

THE Metrovick prototype F.2 Series 4 engine (No. 41) has recently been stripped for inspection following a series of 100-hour endurance tests. The total running time of the engine is now 1,007 hours 45 minutes, all of which has been done on the bench. This is a very creditable achievement, particularly when it is borne in mind that bench-running is always more severe than flight work in that the engine is operating under maximum stress and temperature conditions for the stated r.p.m., and there is no relaxation such as is obtained when flying at altitude. The history of the various components as tabulated below is of particular interest. Unless the part is actually stated to have been discarded it may be assumed that the changes of components have been made so that newer designs could be tested, not because of impending failure.

A further series of endurance tests at a 10 per cent higher rating than the design figure of 3,500 lb static thrust will be undertaken as soon as the engine has been reassembled.

In order to investigate the suitability of alternative fuels, a series of five 100-hour runs have been made, each with a different fuel, and provisional results indicate that performance is unchanged but that the heavier fuels give a rather heavier carbon deposit. Manchester air generally causes a slight loss of power amounting to about 100 lb of thrust on a 100-hour run. Although the air is filtered, a certain amount of grease deposits on the trailing edges of blades, and dirt then builds up on it. In flight the blades remain quite clean. At present the F.2/4 has the usual provisional flight clearance period of 25 hours, but a 100-hour type test on the series 4A engine at a static thrust of 3,900 lb has recently been completed and confirmation of results is awaited. On inspection the parts of this unit were found to be in perfect condition, and the engine will be reassembled for further development work as soon as the type-test certificate is issued.

High-altitude flying experience is also being gained with various units installed in a Lancaster test bed. One engine which has just completed 25 hours' flying at between 25,000 and 30,000 ft, is said, on strip, to have shown hardly a sign of having run at all.

The two units for the Saunders-Roe SR/A1 were delivered some months ago and quite recently a first ground run was made. They are provisionally rated at 3,300 lb per engine. A second pair, rated at 3,500 lb, are now ready to replace these after initial flights. Other units for all three boats will shortly be available with the higher rating established during type test. The approved maximum thrust figure may be 3,850 lb.

In a few weeks' time, probably during July, a modified Meteor with two F.2/4s is expected to fly. With more than 7,000 lb thrust the climb of this aircraft should be exceptional.

Component	Hours life	Remarks
Compressor stator ..	1,007.75	None.
Compressor rotor ..	958.75	Another rotor fitted at 628½ hr. for period of 48 hr., after which the 1st rotor was replaced. (Change made to permit investigation of turbine wheel.)
Compressor bearing	472.5	Bearing removed for inspection now in service on another engine.
	331.25	Still in service on Engine 41 Various others used for special tests.
Accessory drives ..	1,000.5	Another set fitted for 7¼ hr. to clear them for a flight engine.
Turbine wheel ..	628.5	Rebladed and put into service on another engine. See note on compressor rotor.
	331.25	Still in service on Engine 41.
Turbine bearing ..	419.25	Replaced by another type.
	331.25	Still in service on Engine 41.
	110.5	Reassembled on another engine. Various others used for special tests.
Fuel burners .. (20 per engine)		3 replaced at 342 hr., 4 replaced at 646 hr., remainder still in service.
Igniters .. .. (2 per engine)	1,002.75	A new type fitted at 646¼ hr. for a special 5 hr. test.
Combustion chamber	261	Replaced. Various other chambers replaced as obsolete.
	331.25	Still in service on Engine 41.

NO LIMIT TO SPEED

G/C. E. M. Donaldson, holder of the world's air speed record, who left for the U.S. on May 29th, was the feature speaker at the National Convention of the National Aeronautical Association at Fort Worth, Texas, last week. Lecturing on "How fast can man expect to fly in the foreseeable future?" he stated, "There is no limit. The problem of flying faster than sound is being overcome rapidly, but we cannot rush experiments."

BRITISH LIGHT ENGINE NEWS

THE Monaco flat-four 100h.p. engine is still undergoing development running, and it is expected to start official type tests within the next few months. Monacos are troubled, however, by the lack of a suitable British carburettor and, in view of this, are seriously contemplating the use of fuel injection by an S.U. pump supplying nozzles at each inlet port.

A factory has been acquired at King's Langley, Herts, and is at present being equipped. So soon as this can be completed, production of the engine will start, and, provided that no major snags arise in the meantime, the first batch of production engines should emerge at the beginning of next year.

An exhibition of the products of local industries was opened at Watford Town Hall on June 5th, and will run until June 18th, being open from 11 a.m. till 9 p.m. each day. The Monaco engine is on show at this exhibition and is fitted with the new de Havilland manually controlled v.p. airscrew.

The Jameson 100 h.p. flat-four light aircraft engine which, as described in our issue of May 23rd, 1946, utilises a revolutionary induction theory, is progressing very favourably. Jamesons have certain test facilities, made available by the M.o.S., which, in addition to giving all possible help, has exhibited a great deal of interest in the development of this unique engine.

A further project in Jamesons' development programme is a horizontally opposed flat-eight cylinder unit on similar lines. Indications are that the promising flat-six engine designed by Sir Roy Fedden, and at present in the development stages, may not now be put into production. The report that manufacture of the American Ercoupe has ceased may be one important reason for such a decision, as the makers of this machine were known to be one of the principal firms interested in this Fedden engine.

AIR O.P. OFFICERS ASSOCIATION MEETING

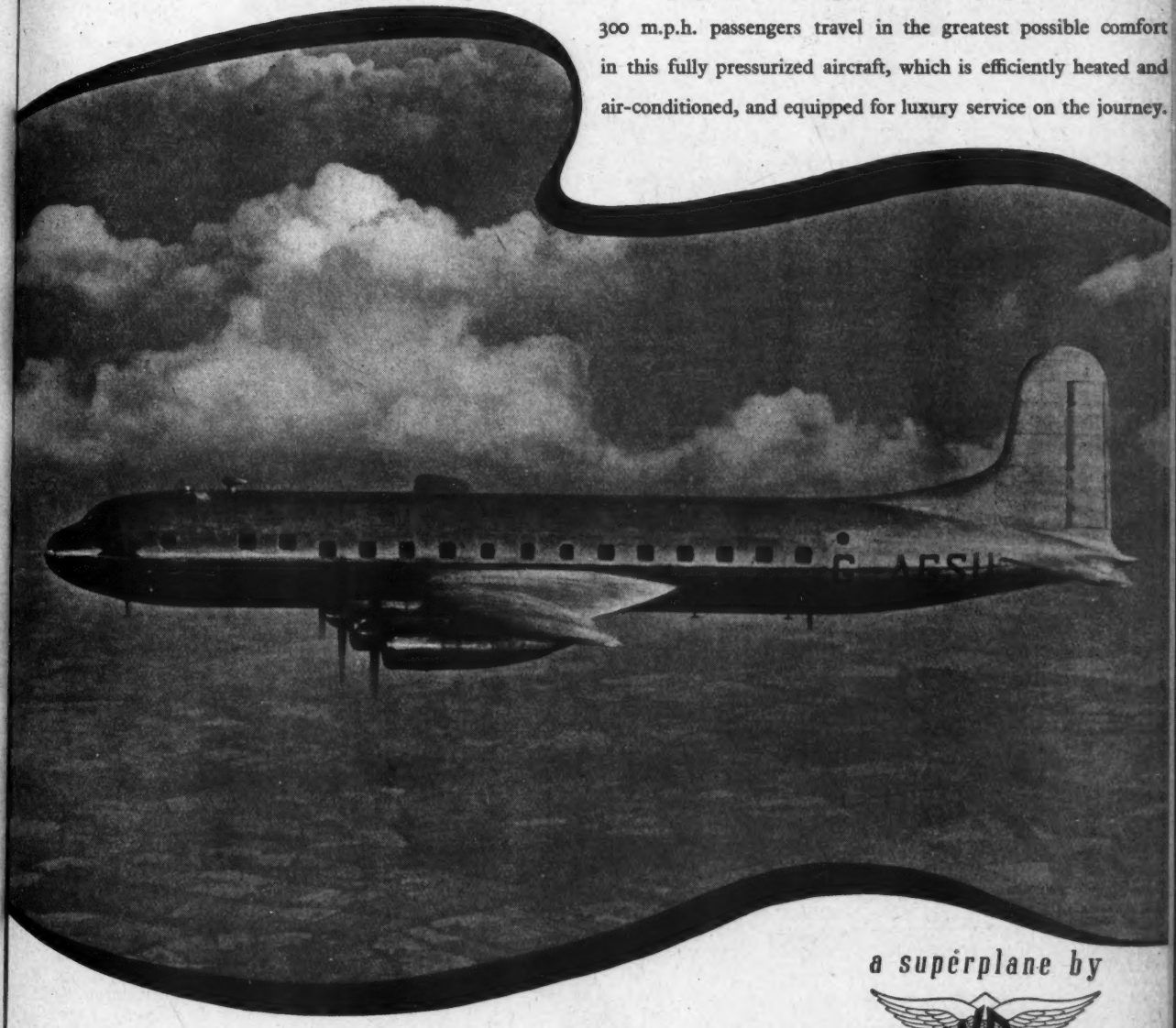
THE first annual gathering of the Air O.P. Officers Association is arranged to coincide with the air rally being held by the Royal Artillery Aero Club on June 13th-15th (announced in *Flight* on May 8th). For these three days, members of the Air O.P. Officers Association are offered honorary membership of the R.A. Aero Club, and also an invitation to attend the R.A. Aero Club Ball at Larkhill on Friday, June 13th.

COVENTRY DISPLAY CANCELLED

THE air display organized by the Air League of the British Empire, which was to have taken place at Baginton airfield on June 14th, has had to be cancelled for the time being. However, it is hoped that the display may take place later in the year.

Pressurized for luxurious travel

Latest of a long line of successful aircraft, the Tudor II is a worthy upholder of the Avro tradition of service on the airways of the world. The fuselage accommodation of the Tudor II varies to meet particular operators' requirements—from 60 seats down to 40—according to the range and layout decided upon. With an economical cruising speed of 235 m.p.h. and a top speed of well over 300 m.p.h. passengers travel in the greatest possible comfort in this fully pressurized aircraft, which is efficiently heated and air-conditioned, and equipped for luxury service on the journey.



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FIVE DAYS with B.A.F.O.

Part II. With the Mosquitoes of 140 Wing : Gliding at Oerlinghausen

Illustrated by Flight Photographs

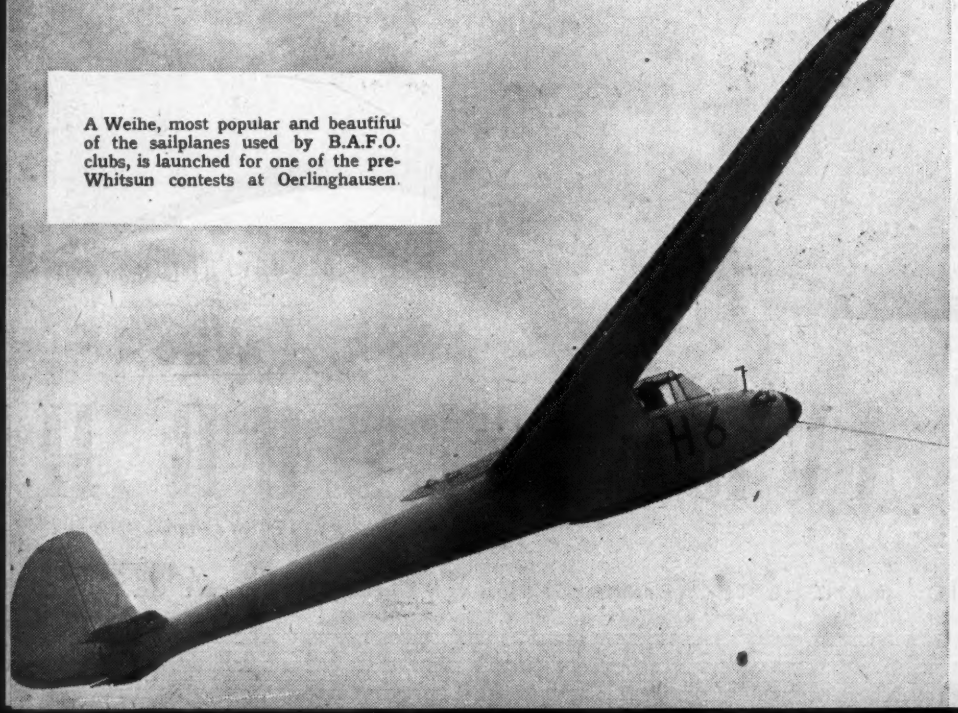
By ——*H. F. KING, M.B.E.*

FROM A.H.Q., B.A.F.O., we pressed on—for none of our short time was to be lost—to the quiet and comfortable home of 140 Wing. Famed for its audacious Mosquito attacks, led by G/C. Pickard and others, the Wing is now commanded by G/C. R. Faville, C.B.E., and comprises Nos. 4, 21 and 107 Squadrons, the respective C.O.s being W/C. R. I. Jones, W/C. L. Joel, D.F.C., and W/C. W. P. Kemp, D.S.O., D.F.C. All three units are equipped with Mosquito Mk. VI fighter-bombers, powered by Merlin 25 engines (single-stage supercharger), armed with four 0.303in Brownings in addition to four 20mm Hispanos, and capable of carrying four 500lb bombs. This Mark of Mosquito is basically the fighter, rather than the bomber airframe having a flat windscreen and side entry door.

In his capacity as Wing Commander Flying, W/C. D. P. Hanafin, D.F.C., A.F.C., co-ordinates training, directed towards proficiency in night interdiction, or, as the G/C. describes it, "stirring up the land battle at night." The value of this type of operation was convincingly demonstrated towards the end of the war, and though the material damage inflicted may have been rather less than was believed at the time, the persistent harassing attacks by heavily armed Mosquito fighter-bombers of 140, and other, Wings certainly kept the enemy's heads down and caused untold disorder tactical, strategical and nervous.

Much of the Wing's flying is done at low level, requiring a high standard of proficiency in map reading. Free of restrictive regulations, the Mosquitoes are often to be seen, singly or in formation, hugging the contours of the rolling countryside, simulating front gun attacks or low-level pinpoint bombing. Frequent exercises are arranged with the 7th Armoured Division — in particular, with the lorried infantry of the 31st Brigade—in which live ammunition is fired and 250lb infantry training bombs are dropped. These prove to the troops that the Germans were only showing prudence in keeping their heads down when the "Mossies" were about.

A number of long-distance "reinforcement" training flights (Operation "Sunshine") have been made by aircraft of the Wing over the Alps to Italy, but the route now



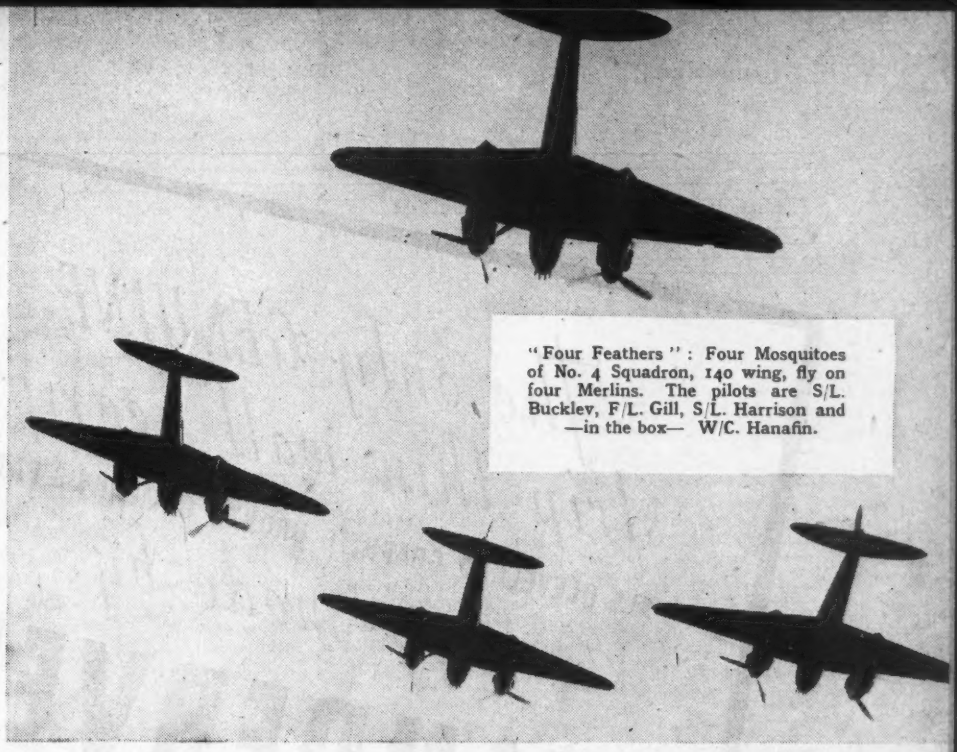
A Weihe, most popular and beautiful of the sailplanes used by B.A.F.O. clubs, is launched for one of the pre-Whitsun contests at Oerlinghausen.

taken (two aircraft were flying it during our stay, the pilots appearing back in the mess on our last night) is Istres, Castel Benito, El Adem and Luqa.

Another duty — useful alike to the Wing, for providing practice in low-level formation flying, and to the Military Government in showing the flag — is Operation "Shambles," calling for periodic flights over the devastated cities of the Ruhr. With S/L. Buckley, of No. 4 Squadron, we flew in the leading formation on one such flight. Down at times to 500ft or less, and cruising at 220 m.p.h., we were continually distracted from our survey of the appalling bomb damage by gigantic chimneys rearing up, singly and in groups, from the industrial haze. One of a group of three of these, lying to port, was announced by W/C. Hanafin, flying in the lead, as being that with which an Anson had recently collided, killing everyone on board. We saw Dortmund, Dusseldorf and Essen, and passed directly over Krupps. Some Germans paused and gazed at us; others seemed not to notice.

This show of strength completed, four Mosquitoes remained airborne to demonstrate a little party trick perfected by No. 4 Squadron. Our own machine assumed the lead in a vic of three, and the Wing Commander Flying took station "in the box." On instructions from S/L. Buckley, the four aircraft opened out slightly and upon the command "Feather fans—go," starboard airscrews were feathered, the aircraft rapidly retrimmed, and tight formation was once again assumed for some low runs over the airfield, to the immense satisfaction of the ground crews. The fitters of No. 4 Squadron are often heard to claim that it is only really necessary to "D.I." one engine in each of their aircraft.

A night flying exercise had been arranged for the evening in which four Mosquitoes from the Wing represented a raiding force over Northern Germany, to provide practice for the specialized night fighters we had seen at Lubeck. They were duly intercepted, as, of course, they usually are on such schemes, and long past midnight, at the end of their two-hour flight, we drove out to the airfield to watch their return. The flickering exhausts showed like gun flashes from the leading edges, as, one by one, the machines materialized out of the darkness to touch down with a metallic jar on the steel-mesh runway. The landings were all safe ones, but W/C. Hanafin—an old hand from Vickers Virginia days—had a critical word to say about each.



"Four Feathers": Four Mosquitoes of No. 4 Squadron, 140 wing, fly on four Merlins. The pilots are S/L. Buckley, F/L. Gill, S/L. Harrison and —in the box— W/C. Hanafin.

LAST week, as the outcome of a visit to B.A.F.O. units by a "Flight" representative, a description was given of the training which takes place at Lubeck, and of a demonstration by Tempests of 135 Wing. This week we present an account of the work of 140 Wing (Mosquito VI), and of the activities of the B.A.F.O. gliding clubs.

G/C Faville (left) expresses approval of a verbal report by W/C Hanafin, Wing Commander Flying.

Living Conditions

Unhappily we had no time to accept invitations to the homes of officers, but we learned something of living conditions. Many officers, N.C.O.s and airmen now have their wives and families with them, and are well housed, with a maid where needed, and with adequate rations and recreational facilities. On the other hand, many junior officers are discovering that financially it is a tight squeeze every month. There is little fresh fruit, though the station occupied by 140 Wing is one of those with its own farm, and the chronic shortage of transport (by no means everyone has his own *Volkswagen*) is often tantalizing.

G/C. Faville is rightly proud of the self-help among the personnel under his command. The station church, in the garret of one of the large buildings, has a simple dignity. Another example of resourcefulness is the monthly magazine *Wing*, with its colour printing, good quality paper and high literary standard.

The mess is exceptionally pleasant and well furnished. At the top of a tower in the mess block is a small beamed room, where, it seems, the original residents would foregather for a secluded stein. The commandant, a veteran of '14-'18, would reminisce at length for the edification of his

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FIVE DAYS WITH B.A.F.O.

young officers, and as the evening advanced, his bag of Allied aircraft would grow. Any suggestion of incredulity on the part of his audience would be countered with the fervent hope that, should he be prevaricating, the beam above him might fall. One night, the C.O. having just returned from leave, the beam did fall at the crucial moment. The mechanism by which this was accomplished may still be seen and operated.

On the morning of our last day we drove to the Wing's own gliding site, set on a sandy forested ridge at Oerlinghausen, where perspiring anti-tank gunners gazed enviously from their emplacements at the effortless passage of Weihe sailplanes. The Group Captain Training, B.A.F.O. (G/C. Paul) and F/L. Reade, the chief flying instructor, received us in the friendly clubhouse among the tall trees.

Aims and Authority

The special aims of the clubs, which comprise the Association of B.A.F.O. Gliding Clubs, are to provide flying instruction for ground staff whose duties do not normally take them into the air (this, it is hoped, will encourage suitable airmen to volunteer for the Regular Air Force), and to promote the art of soaring flight in the R.A.F., with the intention of raising the standard of instrument flying and of encouraging the study of meteorology.

In his directive on the subject, the Air Commander-in-Chief has laid down that all gliding clubs in the British Zone of Occupation are required to be members of the Association. In effect, this is the instrument through which he exercises his authority over all gliding (except that undertaken by airborne forces) and soaring.

The soaring sites in use were originally centres for pre-*Luftwaffe* training, many of which, of course, are now totally abandoned. The B.A.F.O. Association has about 500 active members, the largest club being that of 84 Group, with 220 members, operating at Salzgitter. The A.H.Q. club has two sites, one at Schaf-oldenorf and the second, for elementary training, near Minden. 85 Wing do their gliding near Hamburg, in which region the 4th Armoured Brigade is now forming a club of its own. The former 2 Group Club, at Oerlinghausen, is now known as the 140 Wing Club. All B.A.F.O. airfields are provided with a few primary training gliders, and constitute "reservoirs" to feed the three main clubs.

F/O. J. Forbes, who has established a new English goal flight record of 120 miles (Oerlinghausen—Nijmegen). He was flying a Weihe sailplane.

Each club is self-supporting from its own subscriptions and fees, which vary between the clubs and with the rank of the members, about half being officers and half O.Rs. There is now no W.A.A.F. representation, but Army and Navy personnel are eligible, as are male officials of the Control Commission. A hundred A.T.C. instructors are taking advantage of a fortnight's advanced flying course which, including flying and subsistence, costs them about £8 a head. One enthusiast of the forty-odd already passed out managed to get in fifteen hours' gliding during his stay.

Club members are, of course, hoping that when they are posted from Germany their Service gliding activities may not come to an end, and it is encouraging to hear that Fighter Command already has its own club in England.

Nearly three hundred gliders are available to the B.A.F.O. clubs for training and competitive work, but no replacements are being built in Germany. Included in the total are three Mu 13s, one Sperber, six Weihe, twelve Meise (Olympia), eighteen Kranich two-seaters and two Minimoa. The remainder are SG 38 primary trainers, SG 38Bs (similar to the SG 38, but having a nacelle) and Grunau Babies.

Although some use is made of German labour, Germans are not at present permitted to fly or to give instruction. Before long a number of their records may topple, though as yet there is no plan to emulate their formation flights. It was not unusual some years back for sixteen sailplanes to fly for distances of over 180 miles, the best effort of this kind being a trip from the Wasserkuppe to Brno (315 miles) by five aircraft.

Effective camouflage, exemplified in this view of Mosquito VIs (Merlin 25s) of No. 4 Squadron, is particularly important for fighter-bombers which specialize in surprise attacks from low-level.

The Whitsun Meeting

Unhappily the weather over Whitsun permitted competitive flying on three days only, and some pilots were able to make no more than one flight. In the contest for the Brady Trophy—the principal award—the 140 Wing team finished first with 1,633½ points, 84 Group was second with 1,609 points, and the A.H.Q. club third, with a score of 1,019. Individual scores were: F/O J. Forbes 822 points, F/L. R. W. Williams 714, Capt. A. R. E. Claudi 572, and F/L. F. N. Reade 547. All these officers managed to get in three flights each, but F/L. P. Mallett and S/L. I. Bourne, with 468 and 394 points respectively, flew only twice.

Capt. Claudi put up the best distance flight, landing at Liege, about 170 miles from Oerlinghausen and incidentally attained a maximum height of 9,185ft. On the second day of the flying F/O. Forbes established a new English goal flight record by reaching Nijmegen, 120

FIVE DAYS WITH B.A.F.O.

miles away, beating the previous record by six miles. Other achievements worthy of record were a flight of 154 miles by F/O. Forbes, during which he soared to 4,345ft above the level of the launching site, and a goal flight of 100 miles by F/L. Williams.

In the "B" contests the B.A.F.O. Challenge Cup was carried off by the A.H.Q. team, with 276 points; 85 Wing gained 192 points, 140 Wing, 121, and 84 Group, 44½. The best flight in this class was by F/L. M. Twomey, of 85 Wing, who covered 66 miles and gained a height of 6,560ft. Members of the victorious team were Major Van Dearle, F/L. D. G. Reid, Sgt. T. Roberts, Cpl. E. Eborn, and Cpl. G. Barker.

The Oerlinghausen contests made a fine holiday for the participants—even though some of the long-distance pilots we met had had very little sleep for about two days—and for ourselves exemplified the fine spirit of sportsmanship prevailing throughout B.A.F.O. Fortunately there are abundant facilities in the British Zone for sport and recreation. These in themselves are some reward for the splendid manner in which B.A.F.O. is meeting its responsibilities.

Capt. A. R. E. Claudi, who made the best distance flight during the B.A.F.O. contests, flying from Oerlinghausen to Liege, a distance of 170 miles. He reached a height of over 9,000 ft.

Solely for Research

The "Belphegor" for Aerodynamic and Cosmic Ray Study

DURING a considerable period, when economic instability and political uncertainty were the dominant factors in France, the *Armee de l'Air* was allowed to deteriorate from one of the largest and most powerful air forces in the world to a second-rate service, no longer a factor to be considered by France's potential enemies. The French aircraft industry was also reduced to a deplorable condition, with the result that when France entered the war, a state of chaos reigned which largely accounted for France's resounding defeat in the air.

Although the new *Armee de l'Air* will be small, owing to the necessity of keeping national expenditure to a minimum, France does not intend to be caught in a similar predicament should the world once again be plunged into conflict. With this thought uppermost, an intensive research programme is being undertaken and several experimental aircraft are in process of completion by the nationalized industry.

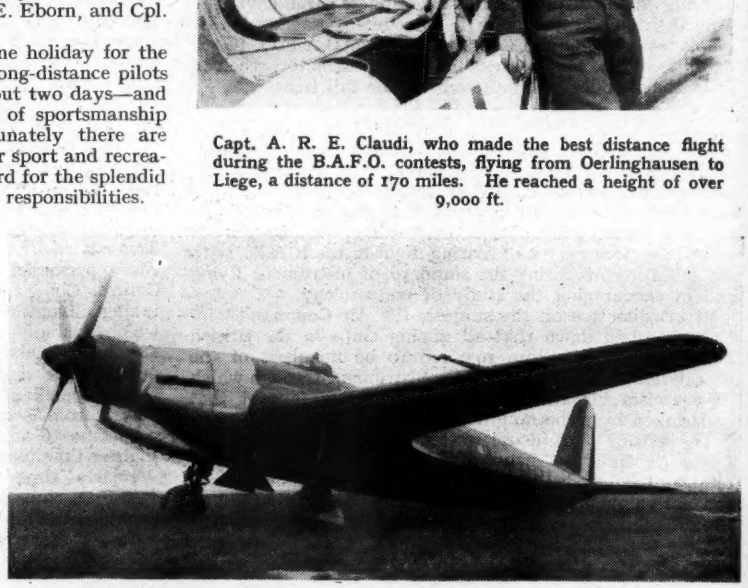
One of the first post-war French aircraft, intended purely for research purposes, is the Aero-Centre N.C. 3021 *Belphegor*, designed for aerodynamic and meteorological research and for the study of cosmic ray phenomena.

Of semi-monocoque, mixed wood and metal construction, the fuselage of the *Belphegor* is composed of three sections, comprising a metal forward section carrying the engine bearers; a central section of Duralumin tubular construction, containing the cabin; and a wooden rear section carrying the tail. The midwing has a steel main-spar, light-metal auxiliary spars and ribs and detachable outer sections. The slotted camber-changing flaps are hydraulically operated. All control surfaces are statically and aerodynamically balanced.

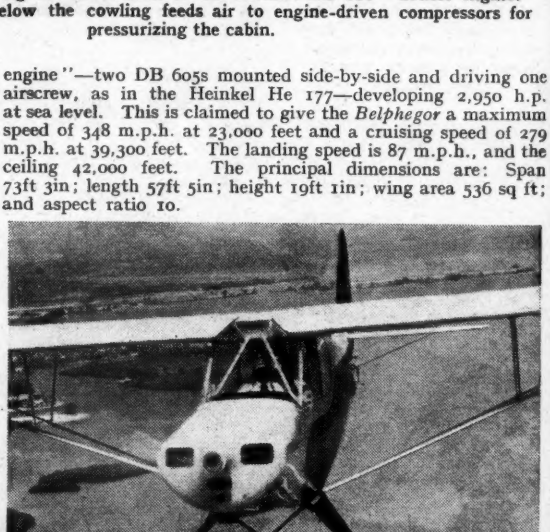
The cabin—of tubular form with a maximum cross-section of 8ft 6in wide by 7ft 6in high—consists of a "double-wall" envelope with two metal sheets spaced by longitudinal beams.

Air pressure is maintained by a large intake below the engine cowling, leading to engine-driven air compressors. Cabin heating is provided by a pipe which runs across the main exhaust and distributes the heated air through inlets in the double skin. In the roof and floor of the cabin are observation posts. Accommodation is provided for a pilot, navigator, radio operator, and two observers.

The power unit is a German Daimler-Benz DB 610 "double-engine"—two DB 605s mounted side-by-side and driving one airscrew, as in the Heinkel He 177—developing 2,950 h.p. at sea level. This is claimed to give the *Belphegor* a maximum speed of 348 m.p.h. at 23,000 feet and a cruising speed of 279 m.p.h. at 39,300 feet. The landing speed is 87 m.p.h., and the ceiling 42,000 feet. The principal dimensions are: Span 73ft 3in; length 57ft 5in; height 19ft 11in; wing area 536 sq ft; and aspect ratio 10.



The *Belphegor*, showing the installation of the German DB 610 "double engine." The large intake below the cowling feeds air to engine-driven compressors for pressurizing the cabin.



NEW PIPER MODEL: The P.A.-11, a successor to the J 3 Piper Cub, is now in production. Basic design is similar but many new features and improvements contribute to give the new model a better performance.

Gas Turbine Combustion

Determination of Efficiency : Airflow Pattern and Turbulence : Fuels and Atomization : Chamber Design : Fire Risk

THE authors of this Paper, *Combustion and Combustion Equipment for Aero Gas Turbines**, have been closely associated with the development of combustion and fuel systems for aircraft turbines throughout the war years. Conditions were such that practical problems had to be given precedence over theoretical ones. As a result the Paper is one written by engineers for engineers, rather than a discussion of the chemical processes involved.

The combustion chamber of a gas turbine is required to burn a very large amount of fuel (on some engines as much as 6,000 to 7,000 lb of kerosene an hour) in a comparatively small space (some 3 to 4 cu ft), and it is therefore of interest to compare its characteristics with those of other fuel-burning appliances. Table I gives some typical figures for heat release in therms per hour.

Combustion efficiency is defined as the ratio of the actual heat developed in the gas stream to the heat content of the fuel fed. In a typical arrangement for

TABLE I

Type of furnace.	Combustion Therms/ft³/hr
Gas burners	
Natural-draught burner ...	0.5 to 0.75
Air-blast burner (2 lb per in²) ...	3 to 7
Low-air-pressure burner (8-in w.g.)	2.25
Concentrated combustion burner	15
Solid-fuel burners	
Locomotive boiler—full power ...	5.7
Marine oil-firing burners	
Maximum present-day design figure	2.9
Gas turbine liquid-fuel burners	
1	234
2	222
3	181

Heat release in various fuel-burning appliances.

determining the combustion efficiency the airflow to the chamber is measured by means of a B.S.I. standard metering orifice. The temperature rise after combustion is determined by traversing the exit from the chamber, using a pitot tube to obtain the velocity at any point and a stagnation thermocouple interchangeable with the pitot tube to obtain the corresponding temperature. The velocity readings enable the temperature observations to be suitably weighted for the associated mass flow and hence enable the weighted mean temperature for the issuing stream to be calculated.

The loss of total pressure (L.T.P.) of a system is defined as the difference between the total pressure of the air entering the system and that of the gases leaving it. It is necessary to traverse the air and gas streams in order to obtain weighted mean values. L.T.P. is of great significance. It is equivalent to a decrease in compressor efficiency, and as such has a marked influence on both the overall thermal efficiency and the gas temperature at the turbine for a given output or, in the jet engine, for a given thrust.

The majority of present turbine engines employ a "straight-through" system in which the direction of flow remains substantially unchanged from compressor to turbine. A complete unit has a plurality of combustion chambers varying from four to sixteen in number which are joined by interconnecting pipes. The outer casing usually tapers from the entry end to the manifold which receives the hot gas and conducts it to the nozzle guide vanes of the turbine. Inside the casing is arranged the flame tube and these are again connected by inner balance pipes located within the interconnectors. These serve as pressure equalizers but also enable flame to be propagated round the complete assembly from an ignition point in one chamber.

In the early days it was customary to divide the combustion chamber proper into primary zone adjacent to the burner, secondary zone where air was added to complete combustion and tertiary zone where air was added to dilute the stream of gases and lower the temperature. Employing an atomized fuel spray, however, combustion normally is more akin to that in a diesel engine than in a gas furnace. Hence the term primary zone might be more strictly described as the combustion zone and the portion of the flame tube further downstream as the mixing zone.

The operation of the combustion system is intimately associated with the airflow pattern from the compressor. With centrifugal compressors, ideal conditions are far from attainable. Table II gives the values for mean air velocity and kinetic head at entry expressed as a percentage of the total pressure of the air stream. It is not only that the velocity of the entering air is high but the motion over the cross-section of the stream is far from uniform either in velocity or direction. The air stream received in the diffuser channels from the impeller is not uniform and has to be turned through approximately a right-angle.

Some 75 per cent of the total airflow enters the annulus between flame tube and outer casing and after cooling the upper portion of the flame tube surrounding the combustion zone passes through the dilution holes. About 25 per cent passes directly into the combustion zone through various devices which have the object of imparting to this portion a definite and controlled pattern.

Entry Swirl

In the first successful chambers used on Whittle engines combustion air was introduced through a large swirler which surrounded the burner. It imparted a rotary motion to the entering air and resulted in the formation of a vortex causing the air near the axis of the flame tube to travel upstream. This reverse flow is found to have a powerful stabilizing effect, anchoring the flame to the burner despite the high mean velocity of the gases in the downstream direction. It had another important effect in that the velocity at any point was much greater than would have been the case if the same mass of air had taken a straight axial course. This high velocity led to the turbulent flow conditions necessary to ensure rapid combustion.

The authors developed a system in which the air entered through a series of holes in a hemispherical closure member of the flame tube. The air enters in a number of converging streams mutually interlacing and giving rise to

TABLE II.

Engine.	1	2	3	4	5	6	7	8	9	10	11
Mean Air Velocity at entry (ft/sec) ...	178	206	359	343	364	240	387	212	363	302	369
Mean Kinetic Head at Entry per cent of Total Press.	0.99	1.38	4.33	3.87	4.31	1.72	4.54	1.38	4.03	2.31	4.5
L/D Ratio $\left(\frac{\text{Length of Gas Path}}{\text{Outercasing Dia.}}\right)$	4.4	3.91	2.70	2.45	2.26	2.55	2.34	3.12	2.60	3.88	2.22
Net L.T.P. per cent of Total Press. ...	3.31	3.90	3.64	6.95	7.52	3.0	7.5	2.7	5.24	5.05	6.73
L.T.P. of Elbow or Inlet Passage per cent of Total Press.	2.05	2.85	3.92	4.25	3.99	1.32	1.7	1.4	—	1.63	1.74
Loading Ratio (lb/hr)/lb $\left(\frac{\text{Fuel Flow per Chamb.}}{\text{Weight of Chamber}}\right)$	7.9	11.3	9.75	17.05	21.3	8.9	—	5.65	—	—	—
Specific Thrust lb/lb $\left(\frac{\text{Thrust}}{\text{Engine Weight}}\right)$	1.837	1.955	2.03	—	3.4	—	—	—	—	—	—
Combustion Intensity CHU/ft³/hr/Atm x 10^{-6}	1.66	2.43	1.83	2.87	2.73	1.94	1.86	2.3	2.02	2.73	2.5
Therms/ft³/hr/Atm.	29.8	43.7	32.9	51.6	49.1	34.9	33.5	41.4	36.3	49.1	45

Performance data of typical Lucas combustion systems.

By
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and
J. S. CLARKE, Ph.D., M.I.Mech.E.

* *Presented before The Institute of Fuel on May 28th, 1947.*

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a state of random turbulence. A small swirler immediately surrounding the burner was retained to provide the necessary stabilizing vortex. This arrangement was first employed on "reverse flow" engines of the original Whittle pattern and for obvious reasons is termed a "colander" system.

Applied to engines of the straight-through type, the colander was surrounded with an additional member, also pierced with holes and situated a short distance away, the space between forming an equalizing zone. A further addition was made in the form of a "snout," so disposed as to pick air off from the stream over a section where its velocity was approximately uniform. The size of the opening was chosen to form a metering orifice, although a second orifice was usually incorporated. This is shown in the general arrangement of a chamber, Fig. 1.

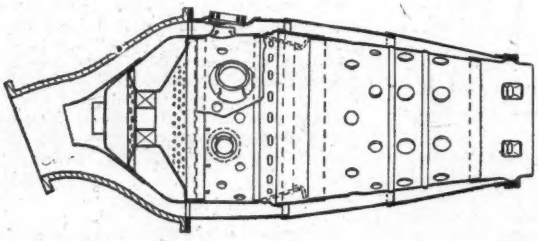


Fig. 1. Arrangement of typical combustion chamber showing "snout," additional orifice and two types of cooling air shoulder.

The fuel is introduced into the combustion chamber as an "atomized" spray of fuel droplets. It would appear that there may, for any prevailing set of conditions, be an optimum degree of atomization. Extremely coarse atomization which results in unburnt fuel passing through the combustion zone will result in a calorific loss. Excessively fine atomization, resulting in the whole of the fuel being gasified before combustion takes place, may also result in a lowering of the combustion efficiency.

Atomizers of the anvil type in which a compact fuel stream impacts on a rigid object have so far met with little success. Atomization resulting from impact of the liquid stream upon the surrounding gas, as in the combustion chamber of a diesel engine, is probably not so well suited to the lower pressures prevailing in a gas turbine.

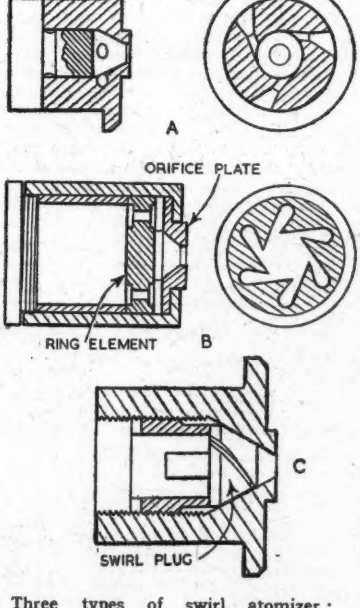
Swirl Atomisers

This method, although still used with success on the Metropolitan-Vickers turbine, is somewhat unpredictable and the angle of divergence of the spray is insufficient to suit most combustion chambers.

Various constructions are possible for the swirl atomizer used in the vast majority of present-day chambers. The most common one is Fig. 2(A) where a series of holes are drilled tangentially into the swirl chamber which is closed at the rear end by an inserted plug. Another is the plate type, Fig. 2(B), where the entry holes take the form of slots pierced in a thin metal plate. In a third type the entry is through a series of helical slots cut in a tapered plug, Fig. 2(C), and in which the entering fuel has a slight forward component in addition to its tangential one.

The tangential velocity increases from its initial value at the entry slots to progressively higher values as it approaches the centre. As velocity would become infinite at the centre where the radius is zero there must be a limit to which the stream can approach the axis and an air core is formed corresponding to that diameter at which the velocity is such that all the pressure energy in the fuel has been converted into kinetic energy.

The fuel therefore traverses the swirl chamber and the exit orifice in the form of a swirling column of liquid surrounding the air core. At the point of emergence from the orifice we have the condition that the tangential velocity increases as we move towards the centre, whereas the axial velocity increases as we move towards the outside. Any elemental annulus of fluid issuing from the orifice would therefore spread out along the surface of a cone, the angle of which is defined by the ratio of tangential to axial velocities. Consideration will show that the apex angle of the cone will be greatest for the fluid nearest the centre where the tangential velocity is greatest and least for that near the inner wall of the orifice, which means again that the inner elemental layers of liquid will tend to penetrate the outer ones.



Three types of swirl atomizer: (A) Tangential hole: (B) Slotted plate; (C) Tapered plug.

An ideal fuel spray would consist of a large number of droplets of uniform diameter. Actually it is a collection of droplets whose diameters vary over a wide range. In a typical spray it is possible to find a small number of 200 microns (0.008in) diameter while the smaller droplets will range in size to below 10 microns (0.0004in) diameter. Combustion will depend not only on the drop sizes present but on their size distribution. A normal spray consists of some 5 to 10 million fuel droplets per c.c. of fuel atomized. The droplet diameter range of 20 to 1 corresponds to a mass range of 8,000 to 1. Unless a very large number of droplets is included in the count, there is the possibility of large droplets being incorrectly estimated and, although these form only a small proportion by number, they form a large proportion by mass.

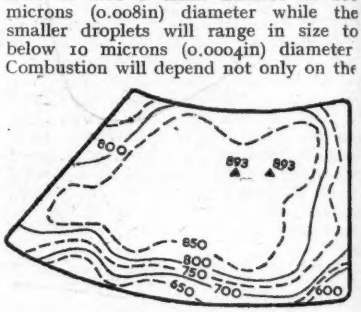


Fig. 3. Temperature contour diagram at turbine entry (Deg. C.)

The problem of igniting a kerosene spray differs from that of igniting petrol. A high-tension plug of modified form and with a gap between the electrodes of the order of 0.060in, must be supplied with a stream of sparks of sufficient duration and energy content to volatilize the fuel droplets before the resulting vapour can be ignited. It is general practice to employ a coil with a high-speed trembler to accentuate the inductance rather than the capacity component of the spark. This is the reverse of the ordinary practice on piston engines.

Torch Ignition

On early designs where the plug was arranged in the main fuel spray it was difficult to find a position where the plug would give good ignition and yet not overheat and burn out in running. Recent practice, however, is to use the torch igniter. In this device the plug is located well away from the combustion zone and a small auxiliary atomizer is arranged adjacent to the plug points. The spray from this atomizer is projected in the form of a torch into the main chamber, thus igniting the main fuel spray.

The time taken for the gases to traverse the combustion zone of a given engine is nearly independent of engine speed over the whole of its operating range; the increase in air mass flow with speed being compensated for by the increased density. Hence the only factors which can influence the time are the cross-section of the combustion chambers and their effective length. The true criterion is the dimensionless ratio of combustion chamber section area to nozzle guide vane area which, on representative modern engines varies from 7 to 14.

It is desirable that the temperature

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in the combustion zone is that corresponding to an overall mixture of correct proportions for complete combustion with a minimum of excess oxygen. It is fairly certain that a substantial gain could be obtained were it possible to use for the flame tube a refractory which could operate at a temperature of 1,600 deg C in place of the present working temperature (approximately 750 deg C).

TABLE III

Fuel	Description	Specific gravity	Net calorific value C.H.U./lb	Net calorific value C.H.U./gallon
A	Aviation petrol ...	0.720	10,510	75,670
B	Wide boiling range similar to American J.P.2 type ...	0.774	10,450	80,880
C.	Paraffinic. Of the kerosene boiling range	0.777	10,530	81,820
D	A kerosene with the majority of its aromatics and sulphur removed...	0.806	10,420	83,990
E	Aviation kerosene	0.810	10,310	83,510
F	Fuel oil	0.933	9,840	91,810
G	"Tetranap" ... An aromatic fuel	0.966	9,690	93,600

Variation of net calorific value with specific gravity.

Unfortunately, lack of mechanical strength and the disastrous consequences of pieces of flame tube passing into the turbine have so far precluded any development of this kind for aircraft.

The factor which can be varied over the widest range is turbulence, but here again a limit is set by the maximum L.T.P. permissible. For a fixed value of the pressure drop the best design will be that which gives the minimum flame length for an agreed temperature distribution. When the flame length is fixed the best design will be that giving the minimum pressure drop for the same quality of temperature traverse.

Flame-tube Temperature

Although from the standpoint of maintaining good combustion efficiency and a short flame length a high flame-tube temperature is desirable, it is found necessary to limit the working temperature to approximately 750-800 deg C, under full load conditions. This is well removed from the softening and oxidation point of the material (Nimonic 75), but the margin is necessary to cope with conditions of rapid acceleration when the engine may be appreciably over-fuelled. On a number of recent engines flame-tube cooling has been greatly assisted by the provision of shoulder holes, two types of which are shown in Fig. 1. A ring of small holes is provided to introduce a proportion of the dilution air as a sheath on the inside surface of the flame tube.

The exit from each combustion chamber is circular while the inlet to the turbine is of a segmental shape. It is necessary to have detailed knowledge of both temperature and velocity distributions at the turbine entry in order to assess both the combustion efficiency and the L.T.P. in the system. Figs. 3 and 4 are typical contour diagrams. While the aim is to obtain as uniform a temperature distribution as possible, some latitude can be permitted if the highest temperature does not occur near the turbine blade roots where the metal is most highly stressed. With the high velocities and high rates of heat transfer from gas to metal and the low thermal conductivity of the heat-resisting alloys, the heat flow along the blade does little in the way of smoothing out any irregularity in temperature distribution.

The range of an aircraft depends primarily on the amount of "available heat" in the form of fuel that it can

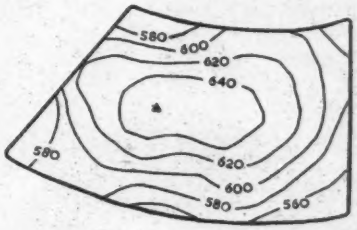


Fig. 4. Velocity contour diagram at turbine entry (ft/sec.)

carry. For a small aircraft such as a fighter, where space is the limiting factor, a high calorific value per unit volume is desirable, while if overall weight imposes the limit, then a high calorific value per unit weight will be advantageous. (Table III.) Fuel storage capacity is closely linked with fire risk. In an aircraft carrier, if the flash point of a fuel is below 150 deg F, special tanks must be used. If the fuel flashes above 150 deg F, special precautions are unnecessary and about 50 per cent more fuel can be carried.

More important is the danger from fire in the air or on crashing. The rapidity with which the inflammation spreads to the main bulk of the fuel is closely linked with its volatility. For fires in an enclosed space, such as a fuel tank, temperature conditions have a major effect. Under very cold conditions, a volatile fuel such as petrol will produce an inflammable fuel-air mixture, while the mixture from a fuel such as kerosene will be below the weak limit of inflammability. On the other hand, in a hot climate the petrol vapour-air mixture will probably be too rich, while that from kerosene will be in the inflammatory range.

A further property that needs attention is the "freezing point" of the fuel. At a temperature some 5 deg to 10 deg C lower than the "cloud point," when solid crystals begin to separate, the fuel will no longer pour. Provisional specifications for the "freezing point" of aircraft gas turbine fuels have been set at -60 deg C and -40 deg C, in U.S.A. and Britain respectively.

The majority of existing engines have a compression ratio of approximately 4:1. Over a wide range of engine r.p.m. conditions combustion efficiency is nearly 100 per cent. At low engine speeds, such as idling, there is a falling off in efficiency, which is influenced by the type of fuel used. The results of combustion efficiency determinations for three chambers from contemporary jet engines at ground-level idling conditions, using various fuels, are given in Table IV.

It is desirable to emphasize the fact that even at 40,000ft difficulties only arise when the engine speed is reduced below the cruising range. At speeds corresponding to cruising, climb or combat conditions, there is no difficulty at such altitudes in maintaining a high combustion efficiency and a short flame.

TABLE IV.

Chamber.	Fuel.	Properties of Fuel. Viscosity at 0 deg. C. c.s.	Density.	50 per cent distilled.	Aromatic content per cent by weight.	Engine Conditions. Per cent full speed.	Air delivery press lb/in² abs.	Air delivery temp. deg. C.	Air mass flow lb/sec.	Fuel flow gal/hr	Type of burner	Atomiser pressure lb/in²	Comb. efficiency per cent.
A	Aviation kerosene	3.42	.810	219.5	15	33	17.5	38	1.18	6.1	Simplex 1.35 FN	20	89
	Petrol ...	0.74	.729	104	10.5	33	"	"	"	"	"	"	94
B	Tetranap	2.3	.966	205	100	30	16.4	30	0.92	5.5	Spill	63	97
											Simplex	17	40
	Pool gas-oil.	8.5	.847	266	19	30	"	"	"	"	Spill	63	95
	Aviation kerosene.	3.42	.810	219.5	15	30	"	"	"	"	Spill	63	97.5
											Simplex 1.35 FN	17	75
	Pool fuel-oil.	180 c.s. pre-heated to 100 deg. C.	.942	—	—	30	"	"	"	"	Spill	63	66
	70½ cetane	8.5	.812	273	Nil	30	"	"	"	"	"	63	94
C	1.	2.53	.825	195.5	23	33	18.5	41	1.81	9.45	Simplex	26	87
	2.	3.34	.810	212.5	15	33	"	"	"	"	"	26	86
	3.	4.04	.834	222.0	20	33	"	"	"	"	"	26	76
	4.	4.75	.862	228.2	28	33	"	"	"	"	"	26	84
	5.	1.61	.774	164.5	13	33	"	"	"	"	"	26	85
	6. (Aviation kerosene)	3.42	.810	219.5	15	33	"	"	"	"	"	26	87
	7.	5.00	.777	199.0	Nil	33	"	"	"	"	"	26	86
	8.	11.62 at —30 deg. C.	.887	215.5	34	33	"	"	"	"	"	26	70

Fuels and performances in three contemporary chambers.

PIGEONHOLED: A Constellation undergoing inspection in special type maintenance docks at a Lockheed service station for multi-engine aircraft at Sayville, N.Y. The tail of another Constellation can be seen on the right, and two D.C.4s are pictured in the background.

Comments Upon British Civil Aviation : Regulations for American Non-scheduled Operators : Corporations' Training Company

I.C.A.O. CONFERENCE ENDS

AFTER more than three weeks of discussions the first assembly of the International Civil Aviation Organization was concluded on May 27th. One of the first tasks of the assembly was to elect a council to serve as the executive body of the organization. The members were divided into three categories and elected by ballot, the first consisting of those eight States which were considered of major importance to air transportation, and the members elected were Belgium, Brazil, Canada, France, Mexico, Netherlands, the U.K. and the U.S.A. The second category consisted of the seven States considered most important in providing facilities for international air navigation, and the members elected were Argentina, Australia, China, Egypt, India, Ireland and Portugal. The third category consisted of six States selected on a geographical basis to assure representation of all the major geographical areas, and the members in this category were Chile, Czechoslovakia, Iraq, Peru, Sweden and Turkey.

Each nation appointed a representative to act on its behalf in the council; the U.K. representative is Sir James Cotton with Mr. Mark Colbeck as the alternate member. The council then elected Dr. Edward Warner as president and Dr. Albert Roper as secretary-general. Dr. Warner had served as president of the interim council of P.I.C.A.O., and Dr. Roper had been secretary-general of the provisional organization.

The budget for the year 1948 was estimated at $2,600,000, an increase of 33 per cent over last year. The largest item was for $1,458,000 for salaries, $420,000 for overhead expenses, and $201,000 for conferences. A $50,000 fund was established for emergency use in cases of breakdown of air navigation facilities. Costs of the organization are borne by members on a sliding scale which considers each State's capacity to pay as well as its interest in aviation.

As announced previously, the assembly considered plans for a working agreement between I.C.A.O. and the United Nations Organization. The Air Navigation and Air Transport Committees are to continue in their present form, and the assembly recommended that a committee on international air law, another on the convention of international civil aviation, and another committee on joint support of air navigation services should be established. It was recommended that the metric measurement system as a primary standard in air/ground communications and in publications should be adopted, but distances would be measured in nautical miles and speed expressed in knots. Members discussed a draft multilateral agreement on commercial rights in the air, and decided to continue work at the meeting which was to be convened in Rio de Janeiro in October this year.

AN AMERICAN AND A BRITISH COMMENT

MR. JAMES LANDIS, chairman of the United States C.A.B., recently stated that American international airlines were worried by the lack of British competition. Whilst giving evidence opposing the bill to establish a single American overseas airline company, he said that the American companies "feared probable restrictive consequences if Britain continued to be unable to make the U.S. pace." He quoted an American view that the British Corporations were becoming "mere national interest prestige carriers," and said that there was widening acceptance of the view that the Corporations were steadily losing ground in the struggle to become commercially sound competitive airlines.

It is rather interesting to note the comment made by Mr. A. S. Butler, chairman of de Havillands, at the annual meeting of the company recently, when he applauded the decision of the Government not to purchase a further batch of American aircraft. The feeling was strong, he said, among those most experienced in the building of airliners, that the original purchase of post-war American aircraft was one involving greater harm to our future than was generally appreciated, and that a further purchase would have been most damaging to British interests, quite apart from the obvious financial objections.

To make available to the builders of future aircraft those lessons which were being learned with competitors' products was helpful in theory, Mr. Butler said, but in practice nothing but the arduous effort of getting our own aircraft right, and the continuous close working with the operating concerns, could provide lessons out of which the next designs would emerge. Thus, purchases of foreign types for major airline work robbed the British industry of an entire phase of develop-

CIVIL AVIATION NEWS

ment, and perpetuated the gap in development which was one of the costs of the war. He estimated, as we reported last week, that a pure-jet airliner, allowing for the large amount of work it could undertake in a year by reason of its speed, may prove to be on all counts a more economical proposition than the existing transports. The D.H.106, he said, was of such a calibre that it was inevitable that a considerable period must elapse before it would be flying on international routes.

U.S. CHARTER REGULATIONS

THE American Civil Aeronautics Board have issued regulations governing the future operations of some air carriers which have hitherto been referred to as "non-scheduled." A new group of operators is to be known as "irregular air carriers" who may engage in common carriage by air of persons or property on an irregular basis without a certificate of public convenience and necessity. Operators in that group will be permitted to carry passengers and freight on internal routes but freight only on the international routes. The other category is to be known as "non-certificated cargo carriers," who may engage without a certificate of public convenience and necessity in carrying freight only, on a regular or irregular basis, on domestic routes but not on international routes. The regulations will increase the measure of regulations for non-scheduled operators.

G.A.P.A.N. COURT FOR NEW YEAR

A THIRD of the Court of the Guild of Air Pilots and Air Navigators retires each year and the vacancies are filled by election, the new Court being confirmed at the Guild's annual meeting on April 10th each year. The Court for the year 1947/48 has, of course, H.R.H. Princess Elizabeth as Grand Master. The Most Hon. the Marquess of Londonderry is Master, and the Deputy Master is W/C. N. H. Woodhead. Wardens are G/C. P. W. S. Bulman, G/C. W. N. Cumming, Capt. A. G. Lamplugh and W/C. C. A. Pike.

Full Members of the Court are Lt. Cdr. Castlemaine, A. Cdre. A. V. Harvey, W/C. H. F. Jenkins, Mr. F. C. Chichester, G/C. D. F. McIntyre, Mr. J. K. Quill, Capt. Gordon Store, Mr. Herbert Sutcliffe and Mr. C. H. Willis. Associate Members are represented on the Court by Miss R. M. H. Russell and Mr. D. H. MacBeath. Service Members are represented by W/C. K. A. Gilfillan and F/L. F. R. Leatherdale. The Test Pilot Members of the Court are S/L. Hartford and Mr. T. S. Wade.

S/L. L. F. Payne is on the Court as representative of the Southampton Branch. The Honorary Wardens of the Court are Viscount Trenchard, Lord Newall, Lord McGowan, Lord Montgomery, Sir W. Sholto Douglas, Sir Edward Ellington, Sir John Salmond, Sir James Somerville and Sir Philip d'Ambrumenile. The Honorary Chaplain is the Rev. John A. Jagoe and the Honorary Medical Advisers are W/C. J. G. MacGown, A Cdre. R. W. Ryan, W/C. R. Winfield, Dr. L. C. Henry. Lt. Cdr. B. J. Hurren is Editor and Mr. L. Wingfield is the Clerk. The Employment Bureau is in the charge of Major J. Cordes and Mr. Ian McNicol is, of course, Secretary-General.

B.O.A.C. AND B.E.A.C. NEW JOINT COMPANY

AS announced in *Flight* last week, the two British Corporations, B.O.A.C. and B.E.A.C., have formed a new company, Airways Training, Ltd., with a nominal share capital of £1,000.

The board has been nominated by the two Corporations and consists of Sir Victor Tait and Mr. G. T. Mellor, of B.O.A.C., and Mr. Philip Wills and Mr. J. E. V. Tysack, representing B.E.A.C. The registered office is at Stratton House, Piccadilly. The training school, at present situated at Aldermaston, near Reading, will be taken over and the company will train those civilian aircrew and ground staff which are required by the Corporations. Hitherto B.O.A.C. have undertaken training for both Corporations, but in the interests of economy, efficiency and impartiality, it has been considered better to set up an independent organization, and the training organizations of B.O.A.C. and B.E.A.C. will disappear.

Training can be centralized up to the point where it has now been found desirable to transfer advance training to the operational lines, and in future the lines will undertake the advance training themselves. It is considered more convenient from the point of view of finance to have the separate company, and it will also permit of training for all civil air transport operators, whether British or foreign. Air Marshal Sir William Welsh, director of training in B.O.A.C., will relinquish his appointment and the staff at Aldermaston have now been seconded to Airways Training. It may, however, be necessary to reduce the strength of the training school.

"*Flight*" photograph.

SABENA AT HEATHROW: The Belgian company transferred its English base from Croydon to London Airport on June 1st. Five return services each week-day are flown between Brussels and London, and three on Sundays. A night freighter is flying six times a week on the same route. From June 15th to September 15th a service will operate to Le Zoute through Ostend twice a day on Monday, Friday and Saturday and once a day the remainder of the week.

CANADIAN TWIN-JET LINER

IN two years or so, says Sir Roy Dobson, a new twin-jet airliner, to be built by A. V. Roe (Canada), Ltd., will be supplied to customers. It is likely to be produced in quantity up to a hundred, both for Canadian use and for export. A thirty-passenger machine, it will probably be the first of its kind to go into service; the first prototype should fly by next summer. Speeds of up to 400 m.p.h. are predicted, and the cabin will be pressurized to maintain sea-level density at 25,000 ft, so that passengers will be comfortable while cruising at 30,000 ft.

The new transport will be used in Canada for inter-city work, and, according to our contemporary, *Canadian Aviation*, will cut travelling time by better than half its present figure.

GOVERNMENT INTEREST IN Q.E.A.

THE Australian Government has decided to purchase the Qantas private shareholding in Qantas Empire Airways, and Mr. W. Hudson Fysh, the chairman and managing director of Q.E.A., has stated that the decision had been made as a result of greatly increased expansion, and capital requirements. It was, he said, in line with governmental policy and previous action with all other main Empire units, which were owned by their respective governments or groups of governments. The company has been operating for twenty-seven years and was founded by Queensland enterprise and shareholders. It is the oldest name in air transport in the Empire and probably the second oldest in the world. The Q.E.A. organization has had considerable experience in operating Empire routes.

CIVIL AVIATION NEWS

BREVITIES

The tenth anniversary of the first flight between Bermuda and the U.S. was celebrated on May 26th. The first services were flown with Imperial Airways' Empire class flying-boats, but the present services are operated three times weekly with Boeing 314A flying-boats. The new Short Bermuda class are expected to start operations at a frequency of one flight each day at the end of this year.

* * *

The AW.55 being built by Armstrong-Whitworth to the Brabazon IIB specification, is to be given the type name "Apollo" in substitution for the original choice of "Avon."

* * *

The recent appointment of Sir Edwin N. Plowden as Chief Planning Officer has necessitated his resignation from the board of the British South American Airways Corporation.

* * *

It is understood that the Chinese Government has approved, without amendment, the air agreement with Great Britain. The agreement was negotiated by a British mission which left for home last month without reaching final agreement. Permission will be granted to B.O.A.C. to extend the Dragon route, which at present ends at Hongkong.

* * *

Mr. W. W. Burkett, C.B.E., M.C., head of the Secretariat and Parliamentary Division of the Ministry of Civil Aviation, has been nominated an Officer in the Order of Orange-Nassau by H.M. Queen of the Netherlands, for services to Anglo-Dutch relations in civil aviation.

The first scheduled flight between New York and Helsinki will be flown by American Overseas Airlines on June 20th. The new service will be run at a frequency of three times a week, stopping at Stockholm.

* * *

The London School of Air Navigation's branch at 25, John Dalton Street, Manchester, is meeting with considerable success. Students receive direct tuition for "B" and 2nd Navigators' licences, and a link trainer is installed.

* * *

Owing to confusion which has arisen between the name of Londonderry Air Charter, Ltd., and the city of Londonderry, the company has changed its name to Ulster Aviation, Ltd., with headquarters still at Newtownards. The name is in keeping with the fact that the company is the first air operating concern in Ulster.

* * *

British European Airways' English Division is starting a new service between Belfast, Carlisle and Newcastle on July 1st, with D.H. Rapides. Flights will be made twice daily, excluding Sundays, and will provide a maximum monthly capacity of 520 seats.

* * *

British South American Airways have introduced a new weekly service between London and Jamaica, calling at Nassau, Bermuda and the Azores. Total time in each direction will be slightly over twenty-four hours. B.S.A.A. now run two services weekly to and from the Caribbean area.

* * *

Pan American Airways started, on June 3rd, the first direct service since the war between China and the United States. The flight will be made weekly by DC-4 aircraft, making only refuelling and crew-change stops at mid-Pacific islands. The time taken between San Francisco and Shanghai is a little over two days in each direction.

FROM THE CLUBS

THE picture on this page shows the manager, Mr. F. E. Darlow, and four flying instructors of the Herts and Essex Aero Club, Broxbourne. At the present time the club is operating seven Tiger Moths, one Hornet Moth and three Proctors. In addition, three Tigers are undergoing overhaul for C. of A. Since the club recommenced activities in May, 1946, 2,395 flying hours have been logged. An additional club amenity will shortly be made available at Broxbourne, when a large static water tank is converted into a swimming pool.

* * *

The Wolverhampton Aero Club was enthusiastically represented at the recent I.O.M. air races. Five aircraft, amongst them a little Piper Cub, took fourteen W.A.C. members to the Island. Mr. Barley, club secretary, told a *Flight* representative that there are now eighteen private owners in the Wolverhampton club, and a fleet of six club aircraft (two Austers, three Miles Hawk Trainers, and one Miles Messenger) are in great demand.

BROXBOURNE GROUP: A recent photograph taken at the Herts and Essex Club shows (left to right): Peter Ayles, D. A. Cather, A.F.M., F. E. Darlow (club manager), S. H. Parker, A.F.M., and A. S. Gilbert.

The United Services Flying Club is to hold a display and rally at Elstree on July 27th. Invitations have been sent out to Continental clubs to attend the rally, so we can look forward to meeting some of our friends from overseas at Elstree. The display is to be preceded by a U.S.F.C. Ball held at the Watford Town Hall on Friday, July 25th. The rally will begin with a breakfast patrol, and flying clubs are invited to "attack" Elstree between 09.00-10.00 hr. (free breakfasts for those who get through!) Elstree will be open to the public and many manufacturers of light aircraft have promised support. The Danish "Lark" is expected to be amongst light aircraft giving flying displays, and it is hoped that a B.O.A.C. flying-boat will demonstrate its capabilities. The United Services Flying Club state that the purpose of the rally is to raise funds to enable the club to reduce flying rates.

* * * *

Figures show that with the advent of better weather, club activities are being enlarged and more and more members are taking to the air whenever the opportunity arises. Since the reopening of the Plymouth and District Aero Club on April 3rd, seventy-nine full members have been enrolled, and during the seven weeks from this date the club's Hornet Moth has put in sixty-five flying hours. The club have taken delivery of a Tiger Moth and are expecting a Fairchild Argus four-seater which will considerably reduce the cost of flying when four members hire it and share expenses. A large number of Service members have joined the Plymouth club, paying a block subscription through their respective messes. On Saturday, June 7th, a "House Warming" party was held between 6 and 7.30 p.m., and a flying display, to take place later in the year, is being planned.

* * *

Flying clubs around the country are reporting an increase in post-war members. The South Coast Flying Club at Shoreham have averaged sixteen new members per month since January 1st. Since April, eight people have successfully gone solo and two "A" licences have been granted.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

PLANNED LABOUR POLICY

A.E.A. Claim Share of Laurels

THE article on Skyways, Limited (*Flight*, May 29th), in which the remarkable success of this company was rightly hailed, hardly told the whole story. As long ago as August, 1944, you were carrying small space advertisements, on behalf of this Association, which urged on the then potential civil aviation industry the necessity of a planned labour policy. One of these, for instance, stated "Planning civil aviation is not merely the business of the Government and the air line operators. The skilled technical workers make their contribution in a planned labour policy through their own trade union, the Aeronautical Engineers' Association."

I am quite certain that Captain Ashley, Skyways' managing director, would be the first to acknowledge that it was this planned labour policy which played a large part in the organization of his maintenance base and therefore in the overall success of the company. Be it noted also that Skyways, whilst paying higher wages for a shorter working week than almost any other British engineering undertaking, still contrive to be profit-making. How very healthy it would be for British aviation as a whole—not excluding the Government's three Corporations—if the system Skyways have proved to-day was adopted generally and at once.

J. H. STEVENSON.
Aeronautical Engineers' Association.

P.F.F. BADGE

Should it be Retained

IT has come to my notice that the privilege of wearing the P.F.F. badge may be withdrawn under modifications now being proposed for R.A.F. Service dress uniform. Although I do not belong to the select few permitted to wear the P.F.F. badge, may I be allowed, through the media of your columns, to protest most strongly against the proposed withdrawal of this little emblem.

Surely those who have earned this distinguishing badge through their courage and devotion to duty are not now going to be asked to "take it down." Air Chief Marshal Sir Arthur Harris explains in his book, "Bomber Offensive," how he was forced, against his wishes, but at the direct command of Air Ministry, to form what he was pleased to call a Corps d'Elite, and the Path Finder Force was brought into being. Is the Air Ministry, after two years of peace, going to forget the heroic part played by the Pathfinders and regret the honour it once bestowed upon them?

In my opinion these comparatively few historic badges should be cherished rather than withdrawn, for do they not mark a page in the history of our battle to final victory?

I am sure that both serving and "civvy street" Pathfinders will agree that the P.F.F. badge must remain.

PILOT NON PATHFINDER.

ACCIDENT TERMINOLOGY

Press Reports Appear Misleading

THIS may appear a trivial matter about which to write to you, but I am sure you will agree with my point of view.

I have always abhorred the word "crash" which is so glibly applied to any accident which occurs to an aircraft, no matter how slight. This word has also found its way into the general Press to such an extent that one sees a headline such as this: "Crash—10 Killed, 8 Injured" and on reading the newspaper finds it has been a motor coach accident, or again "Crash—2 Killed," and thinking again of an aircraft crash we read on and find it was some nitwit on a motor cycle with a pillion rider who has crashed into a lamp standard or a wall, killing himself and his passenger. Previous to the adoption by the Press of aviation jargon they would have been called "serious accidents."

It is therefore to be deplored that when mishaps occur (such as a swing off the runway resulting possibly in damage to the undercarriage causing no injury to personnel, an undercarriage collapse due to a bad landing possibly, one machine colliding with another on the ground when taxying, or, maybe, into a hangar door or obstruction), they should be spoken of as crashes.

In my view they are not crashes but purely accidents.

T. NEVILLE STACK.
General Manager,
Hunting Air Travel, Ltd.

LEGGING IT ROUND THE ISLAND

Why One Gemini Did Not Retract

IN your report of the Isle of Man race, you note the fact that both of the Miles Geminis completed part of the course with their undercarriages down. In fairness to the aircraft, I would like to point out that, in my case (Gemini No. 8), it was entirely a case of pilot trouble.

The Gemini undercart is operated by electric actuators. There is a master switch for the electrical services, and this I forgot to switch on. Consequently, when I selected "up," nothing happened.

I discovered the oversight at the beginning of the second lap when I attempted to check the fuel gauges.

HUGH KENDALL.

RE-EQUIPPING BOMBER COMMAND

Where are the New Prototypes?

THE declared aim of Bomber Command being, as reported in *Flight* last week, the creation of a small but very effective striking force, it comes as something of a shock that as yet not a single turbine-powered bomber is flying in Great Britain, though in America trials are under way on several promising designs. Even the Meteor IV, is seems, is not cleared to carry a bomb load. Worse still, the Lancaster, even at this date, has not been entirely superseded in Bomber Command by the Lincoln, and apart from the Shackleton—strictly a Coastal Command requirement—no Lincoln development is foreseen.

Obviously, the Americans will have no jet bomber squadrons for two years or so, although a production order has been placed for one four-jet type, but in the meantime the U.S.A.A.F. will be well served not only by the B-29 Superfortress (a more modern design than the Lincoln), but by its 400-m.p.h. development, the B-50. Moreover, it will not be long before at least one American squadron will be armed with bombers as large as the Brabazon I. I refer, of course, to the Consolidated Vultee B-36.

Can it be that Mr. Chadwick did too good a job in designing the Lancaster, and that its all-round excellence has led to complacency in the technical requirements branch?

T. I. MARKER.

FORTHCOMING EVENTS.

June 14th and 15th.—Royal Artillery Aero Club: Rally. Thruxton airfield.
June 14th.—Inst. of Physics: Summer Meeting. "Cathode Emission."
June 14th.—Air League of the British Empire: Display at Baginton airfield, Coventry.
June 14th. and 15th.—Aero Club de Caen et du Calvados: Anglo-French air Rally.
June 20th and 21st.—Derby Aero Club: International air rally. Burnaston Airport.
June 21st to 29th.—British Gliding Association: National Gliding Contests. Bramcote airfield, Nuneaton.
June 21st. and 22nd.—Aero Club de l'Ouest de la France. International air Rally, Angiers.
June 21st. to 23rd.—Aero Club of Namur: International air rally.
June 22nd.—Swiss Aero Club: International model contests.
June 25th.—S.B.A.C. Annual General Meeting.
June 28th.—South Coast Flying Club: Tea patrol, Shoreham Airport.
June 28th and 29th.—Luton Flying Club: Summer meeting, display and competitions.
June 28th to 30th.—Aero Club of Le Puy en Velay: Rallye Lafayette.
June 29th.—Auster Flying Club: Annual air rally. Rearsby airfield, Leicester.
July 2nd to 23rd.—Air League of British Empire: Blackpool (Squires Gate) Flying displays with R.A.F. support on 9th, 16th and 23rd.
July 4th to 20th.—Brussels International Aero Show.
July 6th.—Gloucester Flying Club: At Home and flying display, Staverton airfield.
July 12th to 14th.—Deauville International Air Rally.
July 13th.—Royal Aero Club of Belgium: International flying meeting at Liege.
July 19th to 21st.—International Air Rally at Knocke Le Zoute.
July 30th to August 9th.—Aero Club of Switzerland: International gliding contest. Samaden in the Engadine.
August 9th and 10th.—Southend flying meeting.
August 30th and 31st.—Cinque-Ports Flying Club: Flying meeting at Lympne airport.
Sept. 3rd to 6th.—Royal Aeronautical Society: Aeronautical Congress.
Sept. 9th to 12th.—S.B.A.C. Exhibition and Display.

COMING ROUND THE MOUNTAIN: A Sikorsky R-6 (Hoverfly II) helicopter leaves the base camp during an R.A.F. mountain rescue exercise in the Rhyader district of Wales. Three Mountain Rescue Units took part in the location of a "crash" and in a search for missing personnel.

Awards

THE KING has been graciously pleased to approve the following awards:

Distinguished Flying Cross.

F/L. John Edward Perkins, R.A.F.V.R., No. 168 Squadron, 2nd T.A.F.

F/O. Charles Rene George Ryan, R.A.F.V.R., No. 405 (R.C.A.F.) Squadron.

British Empire Medal.

A/C.2 Andrew Miners, R.A.F.V.R., R.A.F. Station, Gibraltar, Coastal Command.

F/L. Perkins was engaged on photographic and tactical reconnaissance of the French coast, in the course of which he flew a considerable number of sorties, photographing, among other targets, the V.1 bases, German anti-invasion devices on the beaches and radar equipment on the cliffs. In August, 1944, while on a reconnaissance of the Seine bridges, he discovered a concentration of some 3,000 German vehicles. This officer, adds the citation, was one of the outstanding pilots of his squadron, highly reliable and courageous.

F/O. Ryan was the flight engineer of a Halifax in a daylight attack on Leipzig on April 10th, 1945, when it was severely damaged by an enemy fighter. He assisted the pilot to regain control, and during the return flight the aircraft was kept under control only because he anticipated its reactions to turbulent weather with exceptional skill and accuracy. Without his assistance it would have been impossible to fly the aircraft home, and he knew that a crash-landing was the only means of saving the life of a wounded gunner.

A/C.2 Miners, with a complete disregard of his personal safety, rescued a member of the crew of an American flying boat which caught fire whilst moored in Gibraltar Harbour.

Royal Air Force and Naval Aviation News and Announcements

Heavy Visitors

BY the time this is read a squadron of Boeing B-29 Superfortresses, visiting this country as the guests of the Royal Air Force, should have made their first flight over London and Southern England, having arrived at Marham last Monday.

Led by Colonel Charles L. Sommers, Chief of Staff of the 15th Air Force, the squadron is part of the historic 97th Bombardment Group which made the first American attacks on Germany. Before leaving Andrews Field, Maryland, the crews were inspected by General Carl Spaatz, Commanding General, U.S.A.A.F., and Air Marshal Sir Guy Garrod, head of the Royal Air Force mission to America, accompanied by Mr. Balfour, the British minister.

Opposite number to our own Avro Lincoln heavy bomber, the B-29 has a span of 141ft 3in, and flies at a weight of about 135,000 lb. The armament being for the most part remotely controlled, and the barbettes in consequence being small, the fuselage is comparatively clean, and this, in conjunction with an efficient wing section, permits a maximum speed of about 350 m.p.h. The engines are Wright R-3350-23 eighteen-cylinder radials, fitted with General Electric exhaust-driven turbo superchargers, and driving Hamilton standard constant-speed, full-feathering airscrews.

Although a maximum bomb load of 20,000 lb can be carried on the standard aircraft, it was necessary to modify the B-29 appreciably to permit a 22,000 lb "Grand Slam" to be slung semi-internally.

On the occasion of his birthday on Thursday, June 12th, His Majesty the King has invited 150 officers and men from the crews of the Superfortresses to be present in the forecourt of Buckingham Palace, when, accompanied by Princess Elizabeth, he rides out to attend the traditional ceremony, the Trooping of the Colour, on the Horseguards Parade. A luncheon will be given in their honour by the Air Council, and on their way to visit Bomber Command Headquarters on Friday morning they will also visit Windsor Castle.

No. 144 School Presentation

ON Sunday, June 8th, twelve A.T.C. cadets comprising Course 21 of No. 144 Gliding School, Heston, received their Royal Aero Club "A" certificates from W/C. R. C. Keary, No. 65 London Reserve Group. It had been intended that each cadet should make an "A" certificate flight, but owing to inclement weather this arrangement was cancelled.

R.A.F. at Bisley

IN fierce heat, on June 3rd, members of the R.A.F. Small Arms Association opened their 21st meeting, attended by Marshal of the R.A.F. Lord Tedder, Patron of the Association.

The Longcroft Tyro Challenge Cup

was won by F/L. K. B. McGlashan, with a score of 111, in slow, rapid and snap shooting at 600-300 yards. F/L. B. V. Browse won the Bronze Medal with 107. In the Past Members' Match and Old Comrades' Cup, the Silver Medal was won by A. Cdre. S. Wallingford with 136 points, and the Bronze Medal by S/L. C. Laceby-Stevens with 135. Winner of the Old Comrades' Challenge Cup was W/O. F. H. Ford, and the Auxiliary and Volunteer Reserve Cup and Silver Medal was won by B. Roberts, of Notts University, with 138 points.

On Thursday thirty-eight teams competed for the Trenchard (Station) Rifle Challenge Cup; R.A.F. Station Boscombe Down were victorious, with 1,046 points. The R.A.F. Revolver Championship, Barton Cup, was won by F/L. H. A. Steele with 177. In the Revolver Tyro Competition F/L. Gill and P/O. Harper tied with 139. With a score of 570, Leeming won the Inter-station Revolver Team Match. The Squadron Rifle Challenge Cup was won by 238 Squadron, and in the Rifle Championship and Grand Aggregate Prize S/L. C. C. Willott, of Coastal Command, was victorious with 320 points. Second place was gained by W/C. Hampshire with 313.

Meteors in Malaya

GREAT interest was aroused in Singapore and Malaya by the recent announcement that two Meteor IV fighters had arrived at R.A.F. Station, Tengah. They are now being assembled at the station workshops. Flying trials, to determine how the performance of this type will be affected by Far Eastern climatic conditions, will begin soon. These will last about two months and will involve thirty flying hours.

Appointments

THE Air Ministry announces the following Auxiliary Air Force appointments:—

S/L. The Duke of Newcastle to command No. 3617 (County of Hampshire) Air Defence Unit, A.A.F.

S/L. Claude Merrick, D.F.C., to command No. 3619 (County of Suffolk) Air Defence Unit, A.A.F.

THE Air Ministry announces the following Royal Air Force appointments:—

Air Vice-Marshal Stephen Charles Strafford, C.B., C.B.E., D.F.C., to be Senior Air Staff Officer, Bomber Command;

Air Commodore Thomas Geoffrey Bowler, C.B.E., to be Air Officer Commanding No. 40 Group, Maintenance Command, with the acting rank of Air Vice-Marshal.

Air Vice-Marshal Strafford has been Air Officer Commanding, R.A.F. Iraq, since July, 1945, and was formerly Air Officer in charge of Administration at R.A.F. Headquarters, Middle East, from December, 1944. Previously he was Chief of Operations and Plans at the Headquarters of the Allied Expeditionary Air Force, to which position he was appointed in May, 1944, after having been engaged on Air Staff planning duties at A.E.A.F. Headquarters for six months following a period of similar duties at the Air Ministry. For two years from June, 1941, he was Director of Plans, Royal Air Force Delegation, Washington, after having served at the Air Ministry, in the Directorate of Plans, for six months. Early in the war he commanded a detachment of the Advanced Air Striking Force in France.

Born in November, 1898, at Cirencester, he was educated at Cirencester Grammar School and the Thames Nautical Training School.

Air Vice-Marshal Bowler has been Air Officer Commanding No. 42 Group, Maintenance Command, since November, 1945, and was formerly A.O.C. of No. 57 Wing, Maintenance Command, from August, 1944. Previously he had been for six years at the Air Ministry in the Directorate-General of Equipment of one of the departments of which he was director from May, 1942.

Air Vice-Marshal Bowler was born at Wandsworth on March 1, 1895, and was educated at All Saints' School, Bloxham.

Canadian and Australian Vampires

IN a letter to de Havilland Airport officials, the Hon. Brooke Claxton, Canadian Minister of Defence, has disclosed that Canadian fighter squadrons should be fully equipped with Vampires early in 1948. The first of "around a hundred" machines are now being crated in Great Britain, and should arrive in Canada early in July.

The senior test pilot of the R.A.A.F.—S/L. R. Cumming, A.F.C.—recently air tested the first Vampire to fly in Australia. This aircraft is on loan from the R.A.F. and has been sent to Australia to familiarize R.A.A.F. pilots with its characteristics. Nene-engined Vampires are to be built in Australia.

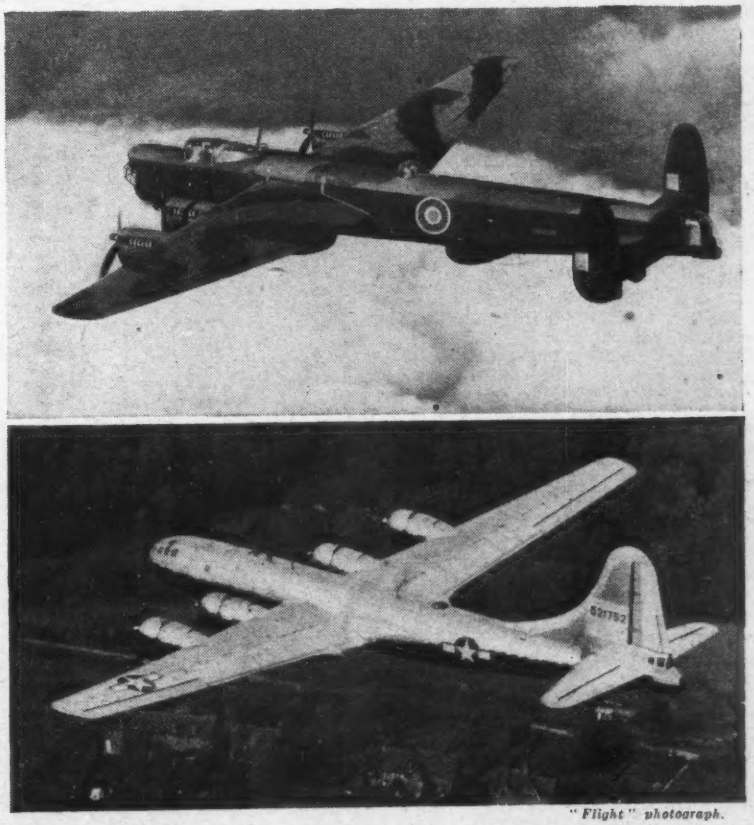
Canadian Jet Fighter

IN addition to the new twin-jet transport mentioned last week, the Malton plant of A. V. Roe (Canada), Ltd., are to build a new long-range high-speed, jet-propelled fighter for the R.C.A.F. Also projected are two new turbine jet units, one of which, it is claimed, will rank as the most powerful in the world.

Indian Air Commodore

AN Indian officer of the Royal Indian Air Force has been promoted to air rank. He is A.Cdre. Subrota Mukerjee, O.B.E., deputy assistant to the Air Officer in charge of Administration at Air Headquarters, India. The Air Commodore is the most senior officer in the R.I.A.F., and was the first Indian officer to be commissioned in it on its formation as the Indian Air Force in August, 1932.

Late last year A.Cdre. Mukerjee came to England to attend the Air Ministry Command Training Conference, and afterwards took a radio familiarization course at the Empire Radio School,



"*Flight*" *photograph.*

COUNTERPARTS: By the time these comparative views of the Avro Lincoln (top) and Boeing B-29 Superfortress have been printed, residents and holidaymakers in Southern England should have seen nine B-29s on one of their two goodwill flights over the British Isles.

SERVICE AVIATION

R.A.F. Debden. Before he returned to India he visited all the R.I.A.F. officers —about forty-five—attending R.A.F. courses in the U.K.

H.M.S. Vengeance for Norway

THE First Sea Lord, Admiral Sir John H. D. Cunningham, G.C.B., M.V.O., flying his flag in the aircraft carrier *H.M.S. Vengeance* (Capt. J. H. F. Crombie, D.S.O., R.N.), arrived in Oslo last Thursday as the guest of the Royal Norwegian Navy.

The Royal Tournament

TO-DAY the Royal Tournament opens at Olympia. Nearly 800 R.A.F. and W.A.A.F. officers, airmen and airwomen, are taking part. A demonstration of elementary and ceremonial precision drill is given by airmen recruits of the Advanced Drill Course; this includes the traditional ceremony of Lowering the Colour, for which music is provided by the pipers and trumpeters of the R.A.F. Apprentices' School.

Home Fleet Summer Cruise

THE summer cruise of the Home Fleet started on May 31st, when most units of the Fleet sailed from Portland under the command of Admiral Sir Neville Syfret, K.C.B., K.B.E., flying his flag in the *Duke of York*. From July 18th to July 27th the Fleet will be in the Clyde, the object of their visit being an expression of appreciation for the help the Navy received from Clydeside during the war. In addition to the battleships *Duke of York, Anson* and *Howe*, and the cruisers *Superb, Cleopatra, Diadem, Dido* and *Sirius*, the aircraft carriers *Vengeance* and *Illustrious* are expected to be present.

Scottish A.A.F. Displays

MORE than 8,000 citizens of Edinburgh accepted the invitation of No. 603 (City of Edinburgh) Fighter Squadron A.A.F., to visit them at Turnhouse on Whit-Saturday. A. Cdre. E. S. Burns, Air Officer Commanding No. 66 (Scottish Reserve) Group, inspected the squadron, drawn up in front of its Spitfires, together with a detachment of Edinburgh A.T.C. cadets.

A display of aerobatics in a Spitfire by F/L R. S. Kingsford was followed by a gliding demonstration by No. 6 (Scottish) Gliding School, A.T.C. Spitfires and Harvards were flown over by No. 602 (Glasgow), 612 (Aberdeen) and 607 (County of Durham) Squadrons, and Seafires and a Barracuda from the Royal Naval Air Station, Donibristle, also called in. A Lancaster flew over at 50ft on two engines, and the flying programme was completed by a fly-past of 603 Squadron's Spitfires, led by S/L. G. K. Gilroy, D.S.O., D.F.C. A crew demonstrated the 40 mm Bofors guns which will eventually be manned by the new 2603 (City of Edinburgh) Squadron, A.A.F. Regiment.

On May 21st more than 15,000 people flocked to Dyce to visit No. 612 (City of Aberdeen) Fighter Squadron, A.A.F. A wide variety of aircraft was on view —Lincolns, Lancasters, Liberators, Seafires, Fireflies, Spitfires, Harvards and Tiger Moths—and there would have been more but for the fact that the Spitfires of the Edinburgh and Glasgow A.A.F. Squadrons were fogbound. A Lincoln flew past on four, three, two, and finally one engine. A.T.C. cadets and their instructors gave a gliding display, and the Aberdeen wing of the Corps paraded for an inspection by A. Cdre Burns.

IMPORTANT MESSENGER : A.V-M. P. E. Maitland, C.B.E., M.V.O., A.F.C., A.O.C. 84 Group, B.A.F.O., chats with W/C. Kearon during a visit in his Messenger to the gliding site at Oerlinghausen. An account of B.A.F.O. gliding activities appears in this issue.

A.T.C. Entry Age

APPROVAL for the minimum age of entry into the Air Training Corps to be lowered by three months (to 15 years) has just been given by the Air Ministry. Prospective cadets will still have to serve a probationary period of three months.

Midland R.N.V.R. Squadron

THE four R.N.V.R. Air Squadrons established by the Admiralty now include a unit to be based at the former Transport Command airfield at Bramcote, near Nuneaton. The squadron will be equipped at the outset with six Seafires and two Harvards, and should be operating by the middle of August.

Other squadrons now forming are the Fighter Anti-Submarine Unit at Abbotsinch and fighter squadrons at Stretton, near Liverpool, and the Royal Naval Air Station, Culham, which will serve the London-Oxford area.

Medical Branch—S.S. Commissions

APPROVAL has been given to a scheme to grant short-service commissions to registered medical men of British nationality who wish to serve in the R.A.F. Medical Branch, or who wish to re-enter the Service. By its terms, doctors under 30 years of age on application (for the next few years the age will be 32), will be considered for the grant of commissions for a period of four years on the active list, followed by a period of four years on the reserve. During his service on the active list a medical officer will be considered for the grant of a permanent commission. Should he not be selected for this type of commission he will be eligible for a gratuity of £600 on leaving the Service on completion of four years' active list service.

Trans-Australian Mosquito

A MOSQUITO of the Royal Australian Air Force, averaging 364 m.p.h. on a 5-hour flight from Pearce in West Australia to Point Cook, Victoria, clipped 1 hr 1 min from the previous "record," held by an A.N.A. Skymaster.

Combined North Sea Ops.

COASTAL Command Sunderlands, which should have taken part in the air-sea exercises in the North Sea last Monday, were fog-bound at Alness, and bad flying weather made the operation of other aircraft extremely difficult. Units of the Home Fleet were on passage between the Pentland Firth and Norway, and Coastal aircraft, operating from Scottish bases, had been detailed to locate and shadow them.

The first Lancaster took off on reconnaissance from Leuchars in the early morning, when the cloud base is reported to have been down to about 100ft. Over the North Sea conditions were similar throughout most of the 7½-hour flight, and on its return the Lancaster had to be diverted to Dyce.

The whole operation was controlled by Area Combined Headquarters, Rosyth, and the aircraft were under the operational direction of Headquarters, 18 Group, Coastal Command.

Reunions

A REUNION party for 224 Group officers will be held in the Connaught Rooms, London, on Saturday, June 28th, 1947. All officers who served in 224 Group H.Q., or in any 224 Group unit, between January, 1942, and October, 1945, including A.L.O.s, N.L.O.s and Air Formation Signals attached to the Group, are invited. Tickets, £1 per head, can be obtained from S/L. J. W. Chance, 16, St. George's Square, London, S.W.1.